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DOCUMENTATION OF THE ANALYSIS OF THE BENEFITS AND COSTS OF AERONAUTICAL RESEARCH AND TECHNOLOGY MODELS

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Appendix A
COMMON BLOCK AND VARIABLE DEFINITION

Table A.1 presents common block definition and use information for all common blocks in the ABC-ART program. For each common block, the routines where variables in the block are initially defined, redefined, and used are shown.

In Tables A.2, A.3, and A.4 alphabetical lists of all variables in the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules, respectively, are presented. For each variable, the mode type (real, integer, etc.), the means by which values are assigned (input, calculation, etc.), the dimension if an array, the parameters referenced by each array subscript (aircraft type, year, etc.), the common block membership, the routine where a value was initially assigned, and the definition of the variable are given. The codes used in these tables are given in footnotes to the tables.

Table A.1

COMMON BLOCK DEFINITION AND USAGE

BLOCK NAME	ROUTINES WHERE COMMON BLOCK IS		
	DEFINED	REDEFINED	USED
ACCASHF	CASHFLW		CASHFLW, INRR, INTROR
ACCINCO	REVENUE		REVENUE, CASHFLW, INTROR
ACCOST	CASHFLW		CASHFLW
ACCUMS	SHARE		BET, SHARE, CURVES
CASHFLO	CASHFLW		CASHFLW, INRR, INTROR
COMPCST	COMPCOS		COMPCOS, CASHFLW, INTROR
COSTOT	ACCOST, COMPCOS		ACCOST, COMPCOS, COSTPR
CSHFLO	ACCOST		ACCOST, COMPCOS
CUMOUT	ACCOST		ACCOST, COSTPR
DELAY	RDTE		RDTE
DELIVER	PLANT		PLANT, REVENUE, COMPCOS (inactive)
DEMAND	INPLANT		INPLANT, PLANT
IN			OPLIFE, REPAY, DEPSUB, NETSUB, SUM, CFSUB, DCFSUB, OUTPUT, TAX
INCOME	REVENUE		REVENUE, CASHFLW, INTROR
INDICES	BET		BET, AMORITZ, MODS, BUYS, PLOTSGL, INPLANT
LIFETIM	INPLANT		PLANT, INPLANT
MARKET	BET		BET, BUYS
MAXP	PLANT		PLANT
MODS	BET		BET, MODS
ORDER	PLANT		PLANT, REVENUE, COMPCOS (inactive)
PERIOD	RDTE		RDTE
PLOTDAT	BET		BET, CURVES, PLOTTER
POP	BET		BET, AMORITZ, BUYS, PLOTSGL, INPLANT
PRDSCHL	PLANT		PLANT, COMPCOS (inactive)
PRICEO	ACPRICE	INPLANT	ACPRICE, INPLANT, REVENUE
PRINT	INPLANT		INPLANT, INTROR
PRODIDS	COMPCOS		COMPCOS, INTROR
PRODUCT	PLANT		PLANT, COMPCOS
RDTECMP	RDTE		RDTE, CASHFLW, INTROR

Table A.1

COMMON BLOCK DEFINITION AND USAGE (Concluded)

BLOCK NAME	ROUTINES WHERE COMMON BLOCK IS		
	DEFINED	REDEFINED	USED
RDTELBL	RDTE		RDTE, INTROR
RESULTS	BET		BET, MODS, BUYS, PLOTSGL
SHARES	SHARE		BET, SHARE
STARTER	BET		BET, CURVES, PLOTTER, PLOTSGL
STARTUP	INPLANT		INPLANT, PLANT
STATLIST	BET	MODS	BET, MODS, AMORTIZ, PLOTSGL
TOTAL	PLANT		PLANT, COMPCOS, REVENUE
TOTALS	BET	BET	BET, SHARE
TRDTEC	ACCOST		ACCOST, RDTE, COSTPR, COMPCOS
TTLCMP	ACCOST		ACCOST, COMPCOS, COSTPR
TTS	PLANT	PLANT	PLANT, RDTE, COMPCOS (inactive)

Table A.2

DEFINITION OF FLEET ACCOUNTING MODULE VARIABLES

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
BUY	R	C				BET	Cumulative number of aircraft brought up through a given year of a particular type or in a market or in all markets.
CARD	A	I	8	DI		UNIT04	Data on an input card.
CURVE	R	C	33	C		PLOTTER	Storage array for RPM or fuel consumption data to be plotted next.
D1	R				STARTER		Not defined.
D2	R				STARTER		Not defined.
DUMMY	R	A	15	DI	STARTER	CURVES	Temporary designation for unused variables in common starter.
DYEAR	I	C				AMORTIZ	Past year such that aircraft bought in that year are of retirement age in the current year.
FBURNED	R	C			TOTALS	BET	Fuel consumed in given year by aircraft of a given type; or cumulative fuel consumed up through a given year by aircraft of a particular type or in a market or in all markets.
FBURNED	R	C	31	Y		PLOTSGL	Fuel consumed in a year by aircraft of a specific type.
FCTFUEL	R	C				BET	Fraction of fuel burned in a given year in a specific market relative to total fuel burned in the year.
FCTPOPL	R	C				BET	Fraction of the number of aircraft in service in a given year in a specific market relative to total aircraft in service in the year.
FCTRPMS	R	C				BET	Fraction of the RPMs generated in a given year in a specific market relative to the total RPMs generated in the year.
FCTSMIS	R	C				BET	Fraction of the seat miles flown in a given year in a specific market relative to the total seat miles flown in the year.

Table A.2 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
FUELBRN	R	C	10,31	A,Y	RESULTS	BET	Fuel consumed per aircraft of each type in each year.
FUELBRN	R	C	30,31	C,Y	PLOTDAT	CURVES	Array for storing fuel consumption data for plotting aircraft market share curves.
GROWTH	R	I	31	Y		BET	Growth rate (in percent) of RPMs for each year.
I	I	C				BET	Various uses: Do loop index, array index, etc.
IN	I	C			INDICES	BET	Index equal to number of existing aircraft types plus one.
IT	I	C				BET	Array element index.
J	I	C				BET	Various uses: Do loop index, array index, etc.
LF	R	I	31	Y	STATLIST	BET	Load factor for flights in a market for each year.
LIFETIM	R	I	10	A	STATLIST	BET	Lifetime or nominal retirement age in years for each type of aircraft.
LOADFCT	R	C				BUYS	Computed load factor for flights in a market in a year when seat miles supplied exceeds number needed to maintain input load factor (decimal).
LUN	I	A				BET	Equal to 9, a logical unit number for the plotter.
LUN11	I	A				BET	Equal to 11, a logical unit number for the plotter.
MARKET	R	C	31	Y	MARKET	BET	Projected RPMs demanded in each year.
MAXFBRN	I	C				PLOTSGL	Maximum value of fuel consumption in hundreds of millions of barrels.
MAXRPMS	I	C				PLOTSGL	Maximum value of RPMs flown in hundreds of billions of miles.
MLIFET	R	I	10	A	MODS	BET	Lifetime or nominal retirement age in years for modified aircraft.
MODATA	A,R	I	7	MD		BET	Temporary storage for seven data items pertaining to modified aircraft: MTYPE, MODYR, MSEATS, MSFC, MSPEED, MUTILIZ, MLIFET.

Table A.2 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
MODYR	R	I	10	A	MODS	BET	Year in which aircraft modification to begin.
MRKT	I	A				BET	Number indicator for each market.
MRKTYPE	A2	I	3	MA	STARTER	BET	Alphanumeric name given each market.
MSEATS	R	I	10	A	MODS	BET	Average number of seats in modified aircraft.
MSFC	R	I	10	A	MODS	BET	Average fuel consumption per seat mile for modified aircraft.
MSPEED	R	I	10	A	MODS	BET	Average speed in miles per hour for modified aircraft.
MTYPE	A	I	10	A	MODS	BET	Alpha descriptor of aircraft type to be modified.
MUTILIZ	R	I	10	A	MODS	BET	Utilization in hours per year for modified aircraft.
NAME	A	C				BET	Alpha descriptor of aircraft type from MODATA(1).
NOBUYS	R	I	10,46	A,Y	POP	BET	Number of aircraft of each type placed in service (bought) in each year.
NOBYS	R	C			TOTALS	BET	Number of aircraft of a specific type bought in a given year.
NOCRVS	I	C			STARTER	CURVES	Number of curves to be plotted.
NOEXPLS	I	I			INDICES	BET	Number of existing aircraft types in a market.
NOMODS	I	I				BET	Number of aircraft types to be modified.
NOMRKSF	I	I,A				PLOTSGL	Number of tick marks on the fuel consumption axis (Y-axis) of plots.
NOMRKSR	I	I,A				PLOTSGL	Number of tick marks on the RPMs axis (Y-axis) of plots.
NONEW	I	I				BET	Number of new aircraft types in a market.
NORETIR	R	I	10,46	A,Y	POP	BET	Number of aircraft retired from service of each type in each year.
NORTR	R	C			TOTALS	BET	Number of aircraft of a given type retired in a given year.

Table A.2 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
OUT	I	C			INDICES	BET	Index equal to total number of existing and new types of aircraft in a market.
PASS	I					AMORTIZ	Variable not used.
PERCENT	R	C			STARTER	BET	RPM growth rate for a market in the base year.
PLOTS	A	I	10	A	STATLIST	BET	Flag indicating whether plots of fuel consumed and RPMs flown versus time are to be provided for an aircraft type.
PLTFUEL	R	C	3	MA	STARTER	BET	Total fuel consumed by all aircraft in a market in 2005.
PLTRPMS	R	C	3	MA	STARTER	BET	Total revenue passenger miles flown by all aircraft in a market in 2005.
POPUL	R	C	10,31	A,Y	POP	BET	Number of aircraft in service of each type in each year.
POPULNO	R	C			TOTALS	BET	Number of aircraft of a given type in service in a specific year.
RETIR	R	C				BET	Cumulative number of aircraft retired up through a given year of a particular type or in a market or in all markets.
RPM	R	C	10,31	A,Y	RESULTS	BET	Revenue passenger statute miles flown per aircraft of each type in each year.
RPMDIFF	R	C				BUYS	Difference between RPMs demanded and those available in a market before aircraft buys in a given year.
RPMS	R	C			TOTALS	BET	RPMs flown in a given year by aircraft of a given type; or cumulative RPMs flown up through a given year by aircraft of a particular type or in a market or in all markets.
RPMS	R	C	31	Y		PLOTSGL	RPMs flown in a year by aircraft of a specific type.
RPMS	R	C	30,31	C,Y	PLOTDAT	CURVES	Array for storing RPMs flown for plotting market share curves.

Table A.2 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
SEATMI	R	C	10,31	A,Y	RESULTS	BET	Number of seat miles flown per aircraft of each type for each year.
SEATS	R	I	10	A	STATLIST	BET	Average number of seats per aircraft of each type.
SFC	R	I	10	A	STATLIST	BET	Average fuel consumption per seat mile flown for each aircraft type.
SHRBUYS	R	C	3,31	MA,Y	SHARES	SHARE	Number of aircraft placed in service in a market in each year.
SHRETIR	R	C	3,31	MA,Y	SHARES	SHARE	Number of aircraft retired from service in a market in each year.
SHRFUEL	R	C	3,31	MA,Y	SHARES	SHARE	Fuel consumption in a market in each year.
SHRPOPL	R	C	3,31	MA,Y	SHARES	SHARE	Number of aircraft in service in a market for each year.
SHRRPMS	R	C	3,31	MA,Y	SHARES	SHARE	RPMs flown in a market in each year.
SHRSMIS	R	C	3,31	MA,Y	SHARES	SHARE	Seat miles flown in a market in each year.
SMILES	R	C			TOTALS	BET	Seat miles flown in a given year by aircraft of a given type; or cumulative seat miles flown up through a given year by aircraft of a particular type or in a market or in all markets.
SPEED	R	I	10	A	STATLIST	BET	Average block-to-block speed for each type of aircraft.
TOPFBRN	R	I,C				PLOTSGL	Maximum value on the fuel consumption axis (Y-axis) of plots.
TOPRPMS	R	I,C				PLOTSGL	Maximum value on the RPMs axis (Y-axis) of plots.
TOTAL	R	C				BUYS	Total RPMs available in a market in a given year before aircraft buys in the year.
TOTLBUY	R	C	31	Y	ACCUMS	SHARE	Total number of aircraft bought in all markets for each year.
TOTLFLB	R	C	31	Y	ACCUMS	SHARE	Total fuel consumed in all markets in each year.

Table A.2 (Concluded)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
TOTLMIS	R	C	31	Y	ACCUMS	SHARE	Total seat miles flown in all markets in each year.
TOTLPOP	R	C	31	Y	ACCUMS	SHARE	Total number of aircraft in service for all markets in each year.
TOTLRPM	R	C	31	Y	ACCUMS	SHARE	Total revenue passenger miles flown in all markets in each year.
TOTLRTR	R	C	31	Y	ACCUMS	SHARE	Total number of aircraft retired from service in all markets for each year.
TYPE	A	I	10	A	STATLIST	BET	Alpha name given to each aircraft type.
UTILIZ	R	I	10	A	STATLIST	BET	Utilization in hours per year per aircraft of each type.
XO	R	A				PLOTSGL	X-coordinate starting value for plots.
XSC	R	C				PLOTSGL	X-coordinate scaling factor for plots.
YEAR	I	C				BET	Index denoting the calendar year.
YEARS	R	C	31	C		PLOTSGL	Calendar year from 1975 through 2005.
YR	I	C				BET	Index indicating the number of the year.
YRINTRO	R	I	10	A	STATLIST	BET	Year of introduction for each aircraft type.
YSC	R	C	31	Y		PLOTSGL	Y-coordinate scaling factor.

FOOTNOTES

[1]Type of variable classification:

- A = Alphanumeric
- A2 = Double precision alphanumeric
- I = Integer
- R = Real

[2]Value mode classifications:

- C = Value calculated in program
- I = Read from input file
- A = Value assigned in program

[3]Indexed parameter for arrays:

- A = Aircraft Type
- MA = Market type
- Y = Number of years
- C = Number of curves
- MD = Modification data
- DI = Data items

Table A.3

DEFINITION OF AIRFRAME MANUFACTURER MODULE VARIABLES

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
ACCASHF	R	C	372	MO		CASHFLW	Accumulated monthly cash flow.
ACCINCO	R	C	372	MO		REVENUE	Accumulated revenue (income) by month.
ACCMP	R	C	11,372	CM,MO		INTROR	Accumulated production costs by component and month.
ACCOST	R	C	372	MO		CASHFLW	Accumulated sum of RDT&E and production costs by month.
ACCUM	R	C				PLANT	Sum of demand at end of each demand year.
ACRDTE	R	C	5,372	CM,MO		INTROR	Accumulated RDT&E costs by component and month.
AD	R	C			COSTOT	ACCOST	Avionics development cost.
ADDE	R	C			COSTOT	ACCOST	Total airframe design and development engineering cost, includes concept formulation and contract definition.
ADI	R	DSD,I				ACCOST	Avionics development cost.
AFSPAO	R	DSD				ACCOST	Airframe spares factor, production phase.
AGEO	R	C			COSTOT	ACCOST	Operational ground support equipment cost.
AGEOI	R	DSD,I				ACCOST	Operational ground support equipment cost.
AGEP	R	C			COSTOT	ACCOST	Ground support equipment development cost.
AGEPI	R	DSD,I				ACCOST	Ground support equipment development cost.
AMFG	R	C			CSHFLO	ACCOST	Airframe manufacturing cost.
AP	R	C			CUMOUT	ACCOST	Average airplane price for Q units.
API	R	C				ACPRICE	Fractional form of average national price/cost index over period of interest.
AQ	R	C			COSTOT	ACCOST	Production total cost for NV airplanes.
AQFEE	R	C			COSTOT	ACCOST	Production phase contractor fee.
ASTOP	R	A				ACPRICE	Indicator for end of data.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
AVGDIF	R	C				PLANT	Months start of production to be offset to improve production schedule.
BBRKPT	I	C				PLANT	Temporary save for "best" period breakpoint.
BIMCI	R	C	31	Y		INRR	Cash flow for eac year.
BRKPT	I	C				PLANT	Loop indicator--year in demand schedule.
BSTOP	R	A				ACPRICE	Set equal to blank word.
C	R	C	37,5	CM,LC	COSTOT	ACCOST	Production cost factors by learning curve step.
C	R	A				ACPRICE	Constant to convert to millions (1.0E-6).
CACS	R	C				ACCOST	Air conditioning system cost.
CAERO	R	C				ACCOST	Aerodynamic control system cost.
CAFCT	R	C				ACCOST	Cumulative total airframe costs for Q units.
CAFCTI	R	C				ACCOST	Cumulative total airframe costs for Q-1 units.
CAFFV	R	C				ACCOST	Flight test vehicle airframe cost.
CAFO	R	C				ACCOST	Production aircraft airframe cost.
CAFO	R	C				COMPCOS	Airframe cost for each unit based on learning curve.
CAFOG	R	C				COMPCOS	Airframe learning curve factor for Nth unit.
CAFO1	R	C				COMPCOS	Airframe learning curve factor for N+1st unit.
CAFUCA	R	C			CUMOUT	ACCOST	Cumulative average unit airframe cost for Q units.
CANTIC	R	C				ACCOST	Anti-icing cost.
CASHFLO	R	C	372	MO		CASHFLW	Cash flow by month.
CAVCT	R	C				ACCOST	Cumulative total avionics costs for Q units.
CAVCTI	R	C				ACCOST	Cumulative total avionics costs for Q-1 units.
CAVFV	R	C				ACCOST	Flight test vehicle avionics cost.
CAVION	R	C			CSHFLO	ACCOST	Avionics system cost.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
CAVO	R	C				ACCOST	Production aircraft avionics cost.
CAVO	R	C				COMPCOS	Avionics cost for each unit based on learning curve.
CAVO0	R	C				COMPCOS	Avionics learning curve factor for Nth unit.
CAVO1	R	C				COMPCOS	Avionics learning curve factor for N+1st unit.
CAVONE	R	C				ACCOST	Avionics equipment cost.
CAVONI	R	C				ACCOST	Avionics installation cost.
CAVONT	R	C				ACCOST	Total avionics equipment and installation cost.
CAVUCA	R	C			CUMOUT	ACCOST	Cumulative average unit avionics cost for Q units.
CBODY	R	C				ACCOST	Aircraft fuselage cost.
CD	R	C			COSTOT	ACCOST	Contract definition phase cost.
CELCAD	R	C				ACCOST	Electrical distribution system cost.
CEMP	R	C				ACCOST	Empennage cost.
CENACC	R	C				ACCOST	Engine accessories cost.
CENGS	R	C				ACCOST	Airplane engines cost.
CF	R	C			COSTOT	ACCOST	Concept formulation phase cost.
CFACS	R	DSD,I				ACCOST	Complexity factor air conditioning system.
CFAERO	R	DSD,I				ACCOST	Complexity factor aerodynamic control system.
CFANTC	R	DSD,I				ACCOST	Complexity factor anti-icing system.
CFASSY	R	C				ACCOST	Final assembly and check-out cost.
CFAVON	R	DSD,I				ACCOST	Complexity factor avionics system.
CFBODY	R	DSD,I				ACCOST	Complexity factor aircraft fuselage.
CFELCD	R	DSD,I				ACCOST	Complexity factor electrical distribution system.
CFEMP	R	DSD,I				ACCOST	Complexity factor empennage structure.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
CFENAC	R	DSD,I				ACCOST	Complexity factor engine accessories.
CFENG	R	DSD,I				ACCOST	Complexity factor airbreathing engines.
CFFUSY	R	DSD,I				ACCOST	Complexity factor fuel system.
CFHNDL	R	DSD,I				ACCOST	Complexity factor for loading and handling.
CFHYCD	R	DSD,I				ACCOST	Complexity factor hydraulic system.
CFINST	R	DSD,I				ACCOST	Complexity factor instrument system.
CFLG	R	DSD,I				ACCOST	Complexity factor alighting gear system.
CFNAC	R	DSD,I				ACCOST	Complexity factor engine nacelles.
CFPACC	R	DSD,I				ACCOST	Complexity factor passenger accommodations.
CFPNCD	R	DSD,I				ACCOST	Complexity factor pneumatic system.
CFPOW	R	DSD,I				ACCOST	Complexity factor auxiliary power system.
CFTREV	R	DSD,I				ACCOST	Complexity factor thrust reverser.
CFUSYS	R	C				ACCOST	Fuel system cost .
CFWING	R	DSD,I				ACCOST	Complexity factor wing structure.
CHANDL	R	C				ACCOST	Load and handling system cost .
CHYCAD	R	C				ACCOST	Hydraulic system cost.
CINST	R	C				ACCOST	Instrument system cost.
CINSTE	R	C				ACCOST	Instrument equipment cost.
CINSTI	R	C				ACCOST	Instrument installation cost.
CLG	R	C				ACCOST	Alighting gear cost .
CNACEL	R	C				ACCOST	Engine nacelles cost.
COMENT	R	I	8	DI		ACPRICE	Input card comments.
COMPCST	R	C	11,372	CM,MO	COMPCST	COMPCOS	Summary array of production costs by component and month.
CONFIG	R	DSD,I				ACCOST	Engineering complexity factor.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
COST	R	C	372	MO		CASHFLW	Sum of RDT&E and production costs each month.
CPACCO	R	C				ACCOST	Passenger accommodations and furnishing cost.
CPCT	R	C				ACCOST	Cumulative total propulsion costs for Q units.
CPCTI	R	C				ACCOST	Cumulative total propulsion costs for Q-1 units.
CPFC	R	C				ACCOST	Flight test vehicle propulsion system cost.
CPNCAD	R	C				ACCOST	Pneumatic system cost.
CPO	R	C				ACCOST	Production aircraft propulsion system cost.
CPO	R	C					Propulsion cost for each unit based on learning curve.
CPOO	R	C					Propulsion learning curve factor for Nth unit.
CPO1	R	C					Propulsion learning curve factor for N+1st unit.
CPOWER	R	C				ACCOST	Auxiliary power system cost.
CPUCA	R	C			C'MOUT	ACCOST	Cummulative average unit propulsion cost for Q units.
CSTRUC	R	C				ACCOST	Assembled airplane cost.
CTJ	R	C				ACCOST	Airplane engine unit cost.
CTJI	R	DSD,I				ACCOST	Input value for airplane engine unit cost.
CTREVS	R	C				ACCOST	Thrust reverser cost.
CV	R	C				ACCOST	Total aircraft manufacturing cost.
CWING	R	C				ACCOST	Wing cost.
DCF	R	C	31	Y		INRR	Discounted cash flow for each year.
DDEL	R	C			COSTOT	ACCOST	Airframe design and development engineering cost.
DEITHPL	I	C				RDTE	Last month before delivery month.
DELAY	I	A	5	CM		RDTE	Delay before RDTE component cost starts (5 factors).

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
DELIVER	I	C	4000	NA	DELIVER	PLANT	Month in which each unit will be delivered (same as PRODUCT).
DELTAP	R	C				INPLANT	Increment for aircraft price.
DELTAR	R	A				INRR	Change in rate for present value calculations.
DELSCHL	I	C	396	MO		PLANT	Cumulative number of units delivered each month (same as PRDSCHL).
DEMAND	R	C	31	Y	DEMAND	INPLANT	No. of one new aircraft type demanded each year.
DISCREP	I	C	29	Y		PLANT	Discrepancy between production possible and demanded.
DS	R	C			COSTOT	ACCOST	Research, development, test and evaluation support.
EAIRFP	R	C				ACPRICE	Estimated airframe price.
EAIRPR	R	C				ACPRICE	Estimated airplane price.
EDEVC	R	C				ACPRICE	Estimated airplane development cost.
EENGPR	R	C				ACPRICE	Estimated engines total price.
EN	R	I				ACPRICE	Number of main engines
EN	R	DSD,I				ACCOST	Number of main engines.
END1	I	C				PLANT	Last month in production schedule for period 1.
END1	I					COMPCOS	Not used.
END2	I	C				PLANT	Last month in production schedule for period 2.
ENSPAO	R	DSD,I			CSHFLO	ACCOST	Main engine spares factor, production phase.
ENSPAR	R	DSD,I				ACCOST	Main engine spares factor, RDT&E phase.
EPRICE	R	C			PRICED	ACPRICE	Estimated airplane market place price.
ESEPRI	R	C	3	A		ACPRICE	Estimated airplane price by seat cost, millions.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
FAC	R	C			COSTOT	ACCOST	Production facilities cost.
FACI	R	DSD,I				ACCOST	Input value of production facilities cost.
FEE	R	DSD,I			CUMOUT	ACCOST	Manufacturer fee factor.
FEE	R	I				ACPRICE	Not used.
FIRSTPR	I	C				PLANT	No. of years in first period.
FP1	I	C				PLANT	Pointer to first year of period 2.
FPROD1	R	C				PLANT	Actual monthly production rate for period 1.
FPROD2	R	C				PLANT	Actual monthly production rate for period 2.
FTO	R	C			COSTOT	ACCOST	Flight test operation cost.
FTOI	R	DSD,I				ACCOST	Input value for flight test operation cost.
FTS	R	C			COSTOT	ACCOST	Flight test aircraft spares cost.
FV	R	C			COSTOT	ACCOST	Flight test vehicles cost.
FVCT	R	C			CUMOUT	ACCOST	Cumulative total airplane costs for Q units.
FVCTI	R	C				ACCOST	Cumulative total airplane costs for Q-1 units.
FVSPAR	R	DSD,I				ACCOST	Flight test vehicle spares.
FVUC	R	C			CUMOUT	ACCOST	Unit airplane cost of Q-th unit.
FVUCA	R	C			CUMOUT	ACCOST	Cumulative average unit airplane cost for Q units.
GTS	R	C			CUMOUT	ACCOST	Ground test vehicle spares cost.
GTSPAR	R	DSD,I				ACCOST	Ground test vehicle spares factor.
GTV	R	C			COSTOT	ACCOST	Ground test vehicles cost.
HP	R	I				ACPRICE	Engine design shaft horsepower.
I	I	LI				INPLANT	Loop index (multiple uses).
IA	I	C	3	DI		ACPRICE	Indicator used in estimating airplane cost.
IACCUM	I	C				PLANT	Rounded (up by .67) sum of units demanded.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
IAIRPL	I	I				ACPRICE	Indicator for airplane type. IAIRPL=1 for conventional jet transports. IAIRPL=2 for small jet transports. IAIRPL=3 for wide body jet transports. IAIRPL=4 for turbo-prop transports. IAIRPL=5 for general aviation types. IAIRPL=6 for supersonic transports.
IB	I	LI				PLANT	Loop index - starts at 2.
ICNT	I	C				INRR	Counter to find every 10th cycle.
ICONFG	I	DSD,I				ACCOST	Indicator for aircraft type, (6 = subsonic production, 7 = prototype, 8 = supersonic production).
ICUM	I	C			CUMOUT	ACCOST	Indicator for cumulative quantity.
IDATA	I	DSD,I				ACCOST	Not used.
IDIFF	I	C				PLANT	Difference between last month of each demand year and month last unit scheduled for production.
IENGS	I	I				ACPRICE	Indicator for type of engines. IENGS=1 for turbojet and turbofan. IENGS=2 for turboprop. IENGS=3 for reciprocating. IENGS=4 for airbreathing.
II	I	LI				ACPRICE	Loop index.
IL	I	C				INRR	Last value of loop index.
IMAX1	I	C				PLANT	Temporary to find largest differences in period 1.
IMAX2	I	C				PLANT	Temporary to find largest differences in period 2.
IMIN1	I	C				PLANT	Temporary to find largest differences in period 1.
IMIN2	I	C				PLANT	Temporary to find largest differences in period 2.

Table 4.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
IMNTH	I	C			STARTUP	INPLANT	Month in which demand begins (years since 1974 x 12).
IN	I	C				RDTE	Starting month for each RDTE component.
INCOME	R	C	372	MO		REVENUE	Total revenue (income) each separate month.
IOPS	I	DSD,I				ACCOST	Indicator for type operational program, 1 = commercial airline, 0 = other.
IP	I	C			PRINT	INPLANT	Print flag for monthly cost, income, and cash-flow tables in INTROR (0=print, 1=no print).
IPOWER	I	DSD,I				ACCOST	Not used.
IPROD	I	DSD,I			CUMOUT	ACCOST	Indicator for prototype or production tooling; 1 = production, 0 = prototype.
IQ	I	DSD,I	33	NA	CUMOUT	ACCOST	Indicator for aircraft quantity matrix.
IR	I	LI				INTROR	Pointer to month within loops.
IS	I	C				INRR	Starting value of loop index.
IT	R	C				ACCOST	Initial flight crew training cost for NV airplanes.
ITH	I	LI				CASHFLW	Component loop index.
ITHPL	I	LI				PLANT	Unit loop index pointer.
ITOTAL	I	C			TOTAL	PLANT	Number of units in period 1.
ITOTAL1	I	C				PLANT	Upward rounded (by .67) number of whole aircraft demanded in period 1.
ITOTAL2	I	C				PLANT	Upward rounded (by .67) number of whole aircraft demanded in period 2.
IV	R	C				ACCOST	Total aircraft production costs for NV airplanes.
IWLG	I	DSD,I				ACCOST	Indicator for landing gear component breakdown.
IYEAR	I	C				PLANT	Loop index for each year of demand.
IYR	I	C				INPLANT	Indicator for first year of demand (since 1974).

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
J	I	LI				INPLANT	Loop index.
JMNTHPL	I	C				PLANT	Offset pointer to month of production for each unit.
K	R	C				INRR	Temporary for accumulated discounted cash flow.
KICKOFF	I	C	29	Y		PLANT	Startup date of production for each period.
KK	R	C				INRR	Temporary for accumulated discounted cash flow.
KKK	R	C				INRR	Temporary for accumulated discounted cash flow.
LB	I	C				PLANT	Loop index.
LEARN	R	DSD,I			CSHFLO	ACCOST	Airframe learning curve.
LEARNA	R	DSD,I			CSHFLO	ACCOST	Avionics learning curve.
LEARNP	R	DSD,I			CSHFLO	ACCOST	Engine learning curve.
LN	I	C				RDTE	Months before production that RDTE component cost starts.
LTIME	I	DSD	372	MO		PLANT	Lead time in months on delivery from order times.
MACH	R	DSD,I			CUMOUT	ACCOST	Maximum design flight mach number for engines.
MAXP	I	C			MAXP	PLANT	Maximum monthly production rate.
MEQ	R	C			COSTOT	ACCOST	Miscellaneous equipment cost.
MIN	I	A				PLANT	Not used.
MINIMAX	I	C				PLANT	Largest difference (in absolute value) for each subdivision.
MNTH	I	LI				CASHFLW	Month loop index.
MNTHPAY	I	C				REVENUE	Monthly payments between order and delivery.
N	I	LI				ACCOST	Loop index.
NCREW	R	DSD,I				ACCOST	Number in flight crew per airplane.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
NDATA	I	DSD,I			COSTOT	ACCOST	Number of positions (from 1 to 5) on learning curve.
NFV	R	DSD,I			COSTOT	ACCOST	Number flight test vehicles.
NG	R	DSD,I			COSTOT	ACCOST	Number of ground test vehicles.
NL	I	C				INRR	Calculated last value of loop index.
NOCOMP	I	A				COMPCOS	Number of production cost components.
NOCON	R	DSD,I				ACCOST	Number of concept formulation contractors.
NOCON1	R	DSD,I				ACCOST	Number of contract definition contractors.
NOENG	R	DSD,I				ACCOST	Number of concept formulation engineers.
NOENG1	R	DSD,I				ACCOST	Number of contract definitions engineers.
NOYRS	R	DSD,I				ACCOST	Number of years for concept formulation.
NOYRS1	R	DSD,I				ACCOST	Number of years for contract definitions.
NPL	R	C				ACCOST	Total number flight crew personnel to be trained.
NTRY	I	C				PLANT	Program control index.
NV	R	DSD,I,C			COSTOT	ACCOST	Number of operational vehicles.
NVEH	R	DSD,I	5	LC	COSTOT	ACCOST	Number of vehicles for which costs to be computed.
NVHF	R	C			COSTOT	ACCOST	Total number flight test and operational vehicles.
NVHF	I	I				ACPRICE	Total number flight test & operational vehicles.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
ORDER	I	C	4000	NA	ORDER	PLANT	Month in which each unit is ordered.
ORITHPL	I	C				REVENUE	Next month after order month.
OS	R	C			COSTOT	ACCOST	Operational vehicles spares cost.
OSA	R	C				ACCOST	Production airframe spares.
OSP	R	C				ACCOST	Production engine spares.
OSPO	R	C				COMPCOS	Engine spares learning cost factor for Nth unit.
OSP1	R	C				COMPCOS	Engine spares learning cost factor for N+1st unit.
OT	R	C			COSTOT	ACCOST	Training equipment cost.
OUT	I	C				RDTE	Ending month for each RDTE component.
OV	R	C			COSTOT	ACCOST	Operational vehicles costs.
PDTJ	R	C			COSTOT	ACCOST	Propulsion development cost turbo-jet engines.
PDTJI	R	DSD,I				ACCOST	Input value for propulsion development cost turbo-jet engines.
PERIOD	I	C			LIFETIM	INPLANT	No. of years new aircraft is demanded.
PERIOD	I	A	5	CM		RDTE	Duration of each RDTE cost component.
PN	R	DSD,I				ACCOST	Total number of passengers.
PN	R	I,A				ACPRICE	Total passenger capacity.
PO	R	I				INPLANT	Base market price of aircraft type.
PP	R	C	20	PE		INPLANT	Array of aircraft price estimates used.
PRODIDS	R	A			PRODIDS	COMPCOS	Array of alphabetic titles for production cost factors.
PRI	R	C				COSTPR	Indicator for vehicle type.
PRICEO	R	C			PRICEO	INPLANT	Price of aircraft.
PRODUCT	I	C	4000	NA	PRODUCT	PLANT	Month in which each unit will be produced.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
PROD1	I	C				PLANT	Upward rounded (by .67) monthly production rate in first period.
PROD2	I	C				PLANT	Upward rounded (by .67) monthly production rate in first period.
PROPU	R	C			CSHFLO	ACCOST	Total propulsion system cost.
PROSCHL	I	C	396	MO	PRDSCHL	PLANT	Cumulative number of units produced each month.
PV	R	C	31	Y		INRR	Present value factor.
Q	R	C				ACCOST	Total number of vehicles manufactured.
R	R	C				INRR	Rate of return difference.
RATE	R	DSD,I			CUMOUT	ACCOST	Vehicle production rate, number/month.
RDFEE	R	C			COSTOT	ACCOST	Contractor fee, RDT&E phase.
RDTE	R	C				ACCOST	Research, development, testing and engineering cost.
RDTECMP	R	C	5,372	CM,MO		RDTE	Monthly breakdown of RDT&E costs by component.
RDTELBL	R	A	5	CM		RDTE	Alphabetic descriptor of RDT&E cost components.
RE	R	DSD,I				ACCOST	Engineering labor rate.
RR	R	C	20	PE		INPLANT	Array of rate of return values based on aircraft price.
RR	R	C				INRR	Rate of return difference.
RT	R	DSD,I				ACCOST	Tooling labor rate.
RRR	R	C				INRR	Rate of return difference.
SC	R	C			CUMOUT	ACCOST	Total manufacturing sustaining costs for Q units.
SE	R	C			COSTOT	ACCOST	Sustaining engineering costs.
SEO	R	C				COMPCOS	Sustaining engineering cost factor for Nth unit.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
SE1	R	C				COMPCOS	Sustaining engineering cost fact for N+1st unit.
SPARES	R	C				COMPCOS	Total spares cost based on learning curve (same as OS).
ST	R	C			COSTOT	ACCOST	Sustaining tooling cost.
STO	R	C				COMPCOS	Tooling and special equipment learning cost factor for Nth unit.
ST1	R	C				COMPCOS	Tooling and special equipment learning cost factor for N+1st unit.
SUBSYS	R	C			COSTOT	ACCOST	Subsystem development cost.
SUBSYI	R	DSD,I				ACCOST	Input value for subsystem development cost.
SUM	R	C				CASHFLW	Used for totaling RDT&E and production costs.
SUM	R	C				INRR	Temporary sum of discounted cash flow.
SUM	R	C				REVENUE	Temporary to accumulate sum by month.
SUM	R	C				INTROR	Temporary to accumulate sum by month.
SUM1	R	C				CASHFLW	Used for totaling RDT&E costs.
SUM2	R	C				CASHFLW	Used for totaling production costs.
SUMDIF	R	C				ACCOST	Sum of differences for each period subdivision.
T	R	I				ACCOST	Thrust per engine at sea level.
TDO	R	C			COSTOT	ACCOST	Production aircraft technical data cost.
TDP	R	C			COSTOT	ACCOST	RDT&E technical data cost.
TITLE	R	I	10	DI		COSTPR	Input title for printouts.
TMC	R	C			CUMOUT	ACCOST	Total of all manufacturing costs for Q units.
TOOLC	R	DSD,I				ACCOST	Complexity factor tooling.
TOTAL	R	C				PLANT	Actual total number of aircraft demanded in both periods.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
TOTAL1	R	C				PLANT	Actual number of craft demanded in 1st period.
TOTAL2	R	C				PLANT	Actual number of craft demanded in 2nd period.
TOVERW	R	C				ACCOST	Total engine thrust over airplane takeoff gross weight.
TPEREN	R	C				ACCOST	Thrust in pounds per engine.
TRDTE	R	C			COSTOT	ACCOST	Total research, development, tooling & engineering cost.
TRDTEC	R	C	5	CM		ACCOST	Array of RDT&E cost factors.
TRI	R	C			COSTOT	ACCOST	Initial transportation cost.
TS	I	C			STARTUP	INPLANT	Same as IMNTH in INPLANT. Month demand for aircraft type starts.
TST	R	C			COSTOT	ACCOST	Tooling and special equipment cost.
TTLCMP	R	C	5	CM		ACCOST	Array of production cost factors.
TTS	I	C			TTS	PLANT	Modified start of production month.
UMC	R	C				COMPCOS	Operational vehicles cost (same as OV).
VMAX	R	C				ACCOST	Maximum vehicle speed, knots.
WA	R	C			CUMOUT	ACCOST	Vehicle AMPR weight.
WACS	R	DSD, I				ACCOST	Air conditioning system weight.
WAERO	R	DSD, I				ACCOST	Aerodynamic control system weight.
WAIRFR	R	C				ACPRICE	Airframe weight.
WANTIC	R	DSD, I				ACCOST	Anti-icing system weight.
WAVION	R	DSD, I				ACCOST	Avionics system weight.
WAVIOT	R	C				ACCOST	Total avionics and instrument weight.
WBODY	R	DSD, I				ACCOST	Fuselage weight.
WE	R	C				ACCOST	Aircraft empty weight.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
WE	R	I				ACPRICE	Aircraft empty weight.
WELCAD	R	DSD,I				ACCOST	Electric power conversion and distribution system weight.
WEMP	R	DSD,I				ACCOST	Empennage weight.
WENACC	R	DSD,I				ACCOST	Engine accessories weight.
WENGS	R	DSD,I				ACCOST	Engines total weight.
WENGS	R	I				ACPRICE	Engines total weight.
WFUSYS	R	DSD,I				ACCOST	Fuel system weight.
WFUIOT	R	DSD,I				ACCOST	Total fuel weight.
WGROSS	R	DSD,I			CUMOUT	ACCOST	Aircraft gross take-off weight (= WG = WTO).
WHANDL	R	DSD,I				ACCOST	Load and handling system weight.
WHYCAD	R	DSD,I				ACCOST	Hydraulic power conversion and distribution system weight.
WINST	R	DSD,I				ACCOST	Instrument system weight.
WLG	R	DSD,I				ACCOST	Alighting gear system weight.
WLGCON	R	DSD,I				ACCOST	Alighting gear controls weight.
WLGSTR	R	DSD,I				ACCOST	Alighting gear structure weight.
WLGIRS	R	DSD,I				ACCOST	Tire weight.
WLGWHL	R	DSD,I				ACCOST	Wheels and brake weight.
WNACEL	R	DSD,I				ACCOST	Engine nacelle weight.
WPACCO	R	DSD,I				ACCOST	Passenge[illegible] tions (and equipment) weight.
WPAYL	R	DSD,I				ACCOST	Payload weight.
WPNCAD	R	DSD,I				ACCOST	Pneumatic power and distribution system weight.
WPOWER	R	DSD,I				ACCOST	Auxiliary power system weight.
WPPROV	R	C				ACCOST	Crew size related subsystem development cost factor.

Table A.3 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
WTREVS	R	DSD,I				ACCOST	Thrust reverser weight.
WWING	R	DSD,I				ACCOST	Wing weight.
SAVD	R	DSD,I				ACCOST	Avionics development factor.
XFASSY	R	DSD,I			CSHFLO	ACCOST	Final assembly-check out cost fraction.
XNEW	R	DSD,I				ACCOST	Miscellaneous equipment development factor.
YEAR	I	LI				INPLANT	Loop index.
YR	I	LI				INPLANT	Loop index.
Z	R	C				ACCOST	Airframe production learning curve cost factor.
ZA	R	C				ACCOST	Avionics production learning curve cost factor.
ZAF	R	C				COMPCOS	Airframe learning curve factor.
ZAV	R	C				COMPCOS	Avionics learning curve factor.
ZETA	R	C				ACCOST	Airframe learning curve exponent.
ZETAA	R	C				ACCOST	Avionics learning curve exponent.
ZETAP	R	C				ACCOST	Engine learning curve exponent.
ZP	R	C				ACCOST	Engine production learning curve cost factor.

FOOTNOTES

[1] Type of variable classification:

I = Integer
R = Real

[2] Value mode classifications:

C = Value calculated in program
I = Read from input file
DSD = Data statement definition
A = Value assigned in program
LI = Loop index

[3] Indexed parameter for arrays:

Y = Number of Years
DI = Data items
CM = Component number
MO = Number of months
NA = Number of aircraft
PE = Price estimates
LC = Learning curve step

Table A.4

DEFINITION OF AIR CARRIER MODULE VARIABLES

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
ADDC	R	I				DIRECT	Costs of added flight crew (over 2), dollars.
AI1	R	I				INDIR	Flight operations expense (less rentals) in dollars per block hour.
AI2	R	I				INDIR	Maintenance expense for flight equipment in dollars per block hour.
AI4	R	I				INDIR	Flight operations expense for rentals in dollars per block hour.
AI5	R	I				INDIR	Cost per stewardess per block hour, dollars.
AI6	R	I				INDIR	Food expense in dollars per passenger per block hour.
AI7	R	I				INDIR	Cost of other passenger in-flight expenses in dollars per passenger-mile.
AI8	R	I				INDIR	Aircraft line servicing expense in dollars per departure.
AI9	R	I				INDIR	Aircraft control servicing expense in dollars per block hour.
AI10	R	I				INDIR	Landing fee per departure in dollars.
AI11	R	I				INDIR	Passenger traffic servicing expense in dollars per passenger.
AI12	R	I				INDIR	Baggage traffic servicing expense in dollars per ton.
AI12A	R	I				INDIR	Cargo traffic servicing expense in dollars per ton.
AI13	R	I				INDIR	Reservation and sales expense per passenger in dollars.
AI14	R	I				INDIR	Reservation and sales expense per passenger-mile in dollars.
AI15	R	I				INDIR	Reservation and sales expense for property in dollars per ton-mile.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
AI16	R	I				INDIR	Advertising and publicity expense per passenger-mile in dollars.
AI17	R	I				INDIR	Advertising and publicity expense for property in dollars per ton-mile.
AI18	R	I				INDIR	Maintenance expense for ground property and equipment per departure in dollars.
AI19	R	I				INDIR	Expense for depreciation and amortization of general ground property and equipment in dollars per departure.
AI20	R	I				INDIR	Maintenance equipment depreciation factor.
AI21	R	I				INDIR	General and administrative expense factor.
ALOSS	R	C				TAX	Yearly total earnings before taxes (where there is a loss), dollars.
AMT	R	A/I				DIRECT/ INDIR	Air maneuver time, hours.
AREV	R	A	25,100	Y,A	IN	INPUTS	Annual revenue, dollars.
BAG	R	I				INDIR	Baggage per passenger in pounds.
BF	R	C	12	ST		DIRECT	Block fuel, pounds.
BS	R	C	12	ST		DIRECT	Block speed, mph.
BT	R	C	12	ST		DIRECT	Block time, hours.
BVALUE	R	C	25,100	Y,A	IN	DEPSUB	Book value of aircraft in specific year, dollars.
C1	R	C	17	ST		INDIR	Flying operations (less rentals) expense, dollars.
C2	R	C	17	ST		INDIR	Maintenance flight equipment expense, dollars.
C4	R	C	17	ST		INDIR	Rentals of flight equipment, dollars.
C6	R	C	17	ST		INDIR	Stewardess expense (first class), dollars.
C7	R	C	17	ST		INDIR	Stewardess expense (coach), dollars.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
C8	R	C	17	ST		INDIR	Stewardess expense (total), dollars.
C9	R	C	17	ST		INDIR	Food expense (first class), dollars.
C10	R	C	17	ST		INDIR	Food expense (coach), dollars.
C11	R	C	17	ST		INDIR	Passenger in flight food expense (total), dollars.
C12	R	C	17	ST		INDIR	Other passenger in-flight expenses (first class), dollars.
C13	R	C	17	ST		INDIR	Other passenger in-flight expenses (coach), dollars.
C14	R	C	17	ST		INDIR	Other passenger in-flight expenses (total), dollars.
C15	R	C	17	ST		INDIR	Aircraft line servicing expense, dollars.
C16	R	C	17	ST		INDIR	Aircraft control servicing expense, dollars.
C17	R	C	17	ST		INDIR	Landing fees, dollars.
C18	R	C	17	ST		INDIR	Passenger traffic servicing expense (first class), dollars.
C19	R	C	17	ST		INDIR	Passenger traffic servicing expense (coach), dollars.
C20	R	C	17	ST		INDIR	Baggage traffic servicing expense (first class), dollars.
C21	R	C	17	ST		INDIR	Baggage traffic servicing expense (coach), dollars.
C22	R	C	17	ST		INDIR	Traffic servicing expense (passengers and baggage), dollars.
C23	R	C	17	ST		INDIR	Traffic servicing expense (cargo), dollars.
C24	R	C	17	ST		INDIR	Reservation and sales expense (first class), dollars.
C25	R	C	17	ST		INDIR	Reservation and sales expense (coach), dollars.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
C26	R	C	17	ST		INDIR	Reservation and sales expense (passenger total), dollars.
C27	R	C	17	ST		INDIR	Reservation and sales expense (property), dollars.
C28	R	C	17	ST		INDIR	Advertising and publicity expense (first class), dollars.
C29	R	C	17	ST		INDIR	Advertising and publicity expense (coach), dollars.
C30	R	C	17	ST		INDIR	Advertising and publicity expense (passenger total), dollars.
C31	R	C	17	ST		INDIR	Advertising and publicity expense (property), dollars.
C32	R	C	17	ST		INDIR	Maintenance expense (ground property and equipment), dollars.
C33	R	C	17	ST		INDIR	Depreciated general ground property and equipment, dollars.
C34	R	C	17	ST		INDIR	Depreciation of maintenance equipment, dollars.
C35	R	C	17	ST		INDIR	General and administrative expense, dollars.
C36	R	C	17	ST			Total indirect operating expense, dollars.
CACM	R	C				DIRECT/ INDIR	Total indirect operating expense, dollars.
CAM	R	C	12/17	ST		DIRECT/ INDIR	Cost per aircraft mile, dollars.
CASM	R	C	12/17	ST		DIRECT/ INDIR	Operating cost per available seat mile, dollars.
CBH	R	C	12/17	ST		DIRECT/ INDIR	Cost per block hour, dollars.
CD	R	A	12	ST		DIRECT	Depreciation on flight equipment, dollars.
CF	R	I	17	ST		INDIR	Passenger trip circuitry factor.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
CF	R	C	25	Y	IN	CFSUB	Net cash flow, dollars.
CFC	R	C	12	ST		DIRECT	Flight crew costs, dollars.
CFH	R	C	12/17	ST		DIRECT/ INDIR	Cost per flight hour, dollars.
CFO	R	C	12	ST		DIRECT	Fuel and oil costs, dollars.
CFOP	R	C	12	ST		DIRECT	Total flying operations cost, dollars.
CG	R	C	25,100	Y,A		TAX	Capital gains, dollars.
CGTAX	R	A				TAX	Capital gains tax rate.
CGTX	R	C	25,100	Y,A		TAX	Capital gains tax, dollars.
CI	R	C	12	ST		DIRECT	Insurance costs, dollars.
CLA	R	C	12	ST		DIRECT	Airframe labor costs, dollars.
CLE	R	I	12	ST		DIRECT	Engine labor costs, dollars.
CLF	R	I	17	ST		INDIR	Coach load factor (decimal).
CLS	R	I				DIRECT	Climb speed, mph.
CLT	R	C				DIRECT/ INDIR	Climb time, hours.
CM	R	C	12	ST		DIRECT	Total direct maintenance costs, dollars.
CMA	R	C	12	ST		DIRECT	Airframe material costs, dollars.
CMB	R	C	12	ST		DIRECT	Maintenance burden, dollars.
CME	R	C	12	ST		DIRECT	Engines material cost, dollars.
COFL	R	I				DIRECT	Cost of fuel, dollars per pound
COIL	R	I				DIRECT	Cost of oil, dollars per gallon.
COST	R	A	25,100	Y,A	IN	QPLIFE INPUTS	Amount of aircraft price financed, dollars.
CRS	R	I				DIRECT INDIR	Cruise speed, mph.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
CRT	R	C	12/17	ST		DIRECT/ INDIR	Cruise time, hours.
CS	R	I				INDIR	Number of coach seats.
CSAREV	R	C			IN	SUM	Cumulative total annual revenue, dollars.
CSCF	R	C			IN	CFSUB	Cumulative total net cash flow, dollars.
CSCM	R	C				DIRECT INDIRECT	Cost per cruise mile per seat, dollars.
CSDCF	R	C			IN	DCFSUB	Cumulative total discounted net cash flow, dollars.
CSDEPR	R	C			IN	SUM	Cumulative total depreciation (double-declining), dollars.
CSEBIT	R	C			IN	SUM	Cumulative total earnings before taxes and interest, dollars.
CSEBT	R	C			IN	SUM TAX	Cumulative total earnings before taxes, dollars.
CSINTI	R	C			IN	SUM	Cumulative total initial investment, dollars.
CSINTX	R	C				SUM,TAX	Cumulative income tax sum, dollars.
CSNTRN	R	C			IN	SUM,TAX	Cumulative total net earnings, dollars.
CSOPCT	R	C			IN	SUM	Cumulative total operating cost, dollars.
CSPRIN	R	C			IN	SUM	Cumulative total yearly principal payment, dollars.
CSTEW	R	I				INDIR	Average number of stewardesses in coach.
CSTO	R	C				DIRECT INDIR	Cost per takeoff per seat, dollars.
CSYNTR	R	C			IN	SUM	Cumulative total yearly interest payment, dollars.
CTO	R	C				DIRECT INDIR	Cost per takeoff, dollars.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
D1	R	I				DIRECT	Distance at maximum payload point on range-payload diagram in miles.
D2	R	I				DIRECT	Distance at maximum fuel point on range-payload diagram in miles.
DIS	R	I	17	ST		INDIR	Passenger trip distance, miles.
DCF	R	C	25	Y	IN	DCFSUB	Discounted cashflow, dollars.
DEPR	R	C	25,100	Y,A	IN	DEPSUB	Depreciation (double-declining), dollars.
DEPREC	R	C	25	Y	IN	SUM,TAX	Total depreciation (straight-line and double-declining), dollars.
DESS	R	I				DIRECT INDIR	Descent speed, mph.
DEST	R	C				DIRECT INDIR	Descent time, hours.
DOC	R	C	25,100	Y,A		INPUTS	Direct operating costs per plane per year, dollars.
DOC1	R	C	100	A		DIRECT	Direct operating costs per plane, dollars.
DPT	R	I	17	ST		INDIR	Departures per passenger trip (flight basis).
EBT	R	C	25,100	Y,A	IN	NETSUB	Earning before taxes, dollars.
EBIAT	R	C	25,100	Y,A	IN	NETSUB	Earnings before interest and taxes, dollars.
ECLIFE	R	A	100	A	IN	INPUTS	Economic life, years.
EXP	R	I	17	ST		INDIR	Fraction of RTP that is express cargo.
F1	R	I				DIRECT	Fuel at maximum payload point on range-payload diagram in pounds.
F2	R	I				DIRECT	Fuel at maximum fuel point on range-payload diagram in pounds.
FCAL	R	C				DIRECT	Coefficient in maintenance labor cost equations.
FCAM	R	C				DIRECT	Coefficient in airframe maintenance material cost equations.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
FCEL	R	C				DIRECT	Coefficient in engine maintenance labor cost equation.
FCEM	R	C				DIRECT	Coefficient in engine maintenance materials cost equation.
FCK	R	I				DIRECT	Flight crew cost factor (for a crew of 2) in dollars.
FHAL	R	C				DIRECT	Coefficient in airframe maintenance labor cost equations.
FHAM	R	C				DIRECT	Coefficient in airframe maintenance material cost equation.
FHEL	R	C				DIRECT	Coefficient in engine labor cost equations.
FHEM	R	C				DIRECT	Coefficient in engine maintenance materials cost equation.
FLF	R	I	17	ST		INDIR	First class load factor (decimal).
FLTT	R	C				DIRECT INDIR	Flight time, hours.
FOODR	R	I				INDIR	Food expense factor for first class.
FS	R	I				INDIR	Number of first class seats.
FSTEW	R	I				INDIR	Average number of stewardesses in first class.
GMT	R	I,A				DIRECT INDIR	Ground maneuver time, hours.
H	R	I				DIRECT INDIR	Cruise altitude, feet.
HINFL	R	A	25	Y		INPUTS	Inflation rate applied to price of aircraft.
I	I	LI			IN	OPLIFE	Pointer indicating year number; also miscellaneous loop index.
IECLIF	I	C				DEPSUB	Midyear of economic life.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
II	I	C				DEPSUB	Loop indicator for year value.
INCTAX	R	C	25,100	Y,A	IN	NETSUB	Income tax, dollars.
INTINV	R	A	25,100	Y,A	IN	OPLIFE INPUTS	Initial investment, dollars.
IOC	I	C	25,100	Y,A		INPUTS	Indirect operating costs per plane per year. dollars.
IOC1	I	C	100	A		INDIR	Indirect operating costs per plane, dollars.
IYEAR	I	A			IN	INPUTS	Total number of years under consideration (set at 15).
J	I	LI				REPAY	Loop index.
K	I	A				DIRECT DEPSUB	Counter, loop index.
L	I	LI				DEPSUB	Loop index.
LL	I	C				DEPSUB	Beginning year of second half of economic life.
M	I	LI				OPLIFE INPUTS	Loop indicator for number of aircraft.
MM	I	C				DEPSUB	Loop indicator for year value.
MPLANE	I	I,A				DIRECT INDIR	Aircraft number for particular input data set.
N	I	LI				REPAY	Loop index.
NAC	I	A			IN	INPUTS	Number of aircraft being considered.
NAME	I		122			INPUTS	Not used.
NLIFE	I	C				DEPSUB	Economic life, years.
NLIFE	I	C				REPAY	Economic life, years.
NN	I	C				REPAY	Loop end indicator for number of years.
NRCREW	I	I				DIRECT	Number in crew.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
NRENGN	I					DIRECT	Number of engines.
NRSEAT	I	I				DIRECT INDIR	Number of seats.
NSL	I	I				DIRECT INDIR	Number of stage lengths (up to 12 for DIRECT, up to 17 for INDIR).
NTEARN	R	C	25,100	Y,A	IN	NETSUB	Net earnings, dollars.
NUSTAG	I,A					DIRECT	Flag to reread name list NSTAGE.
OPCOST	R	C	25,100	Y,A	IN	INPUTS	Operating cost, dollars.
PBCOST	R	C				REPAY	Amount of aircraft price financed, dollars.
PRICE	R	A,C	25,100	Y,A	IN	OPLIFE INPUTS	Price of new aircraft, dollars.
PRIN	R	C	25,100	Y,A	IN	REPAY	Yearly principal payment, dollars.
PV	R	C	25	Y	IN	DCFSUB	Present value discount factor
R	R	A			IN	DCFSUB	Interest rate for PV calculation (ROI).
RATE	R	C				DEPSUB	Rate of depreciation.
RCH	R	I				DIRECT INDIR	Rate of climb at cruise altitude, feet per minute.
RCSL	R	I				DIRECT INDIR	Rate of climb (sea level), feet per minute.
RES	R	A	100	A	IN	INPUTS	Residual fraction of aircraft price for salvage.
RL	R	I				DIRECT	Maintenance labor rate, dollars per hour.
RRATE	R	A	100	A	IN	INPUTS	Interest rate for repayment of purchase loan.
RTE	R	C				INDIR	Express tons enplaned.
RTF	R	C				INDIR	Freight tons enplaned.
RTM	R	I				INDIR	Tons of mail carried per flight.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
RTP	R	I				INDIR	Tons of property (cargo) carried per flight.
SALVAG	R	C	25,100	Y,A	IN	DEPSUB TAX	Value of aircraft at end of economic life, dollars.
SAREV	R	C	25	Y	IN	SUM	Yearly total annual revenue, dollars.
SB	R	C	17	ST		INDIR	Block speed, mph.
SCG	R	C	25	Y		TAX	Total yearly capital gains, dollars.
SCGTX	R	C	25	Y		TAX	Total yearly capital gains tax, dollars.
SDEPR	R	C	25	Y	IN	SUM	Yearly total depreciation (double-declining), dollars.
SEBIAT	R	C	25	Y	IN	SUM	Yearly total earnings before interest and taxes, dollars.
SEBT	R	C	25	Y	IN	SUM	Yearly total earnings before taxes, dollars
SEXP	R	C	25	Y		TAX	Total yearly expenses (excluding taxes), dollars.
SINCOM	R	C	25	Y		TAX	Total yearly earnings before taxes, dollars.
SINCTX	R	C	25	Y	IN	SUM	Yearly income tax sum, dollars.
SL	R	I	12/17	ST		DIRECT/ INDIR	Flight stage length in miles.
SNTERN	R	C	25	Y	IN	SUM	Yearly sum of net earnings, dollars.
SOPCST	R	C	25	Y	IN	SUM	Yearly sum of operating costs, dollars.
SPRIN	R	C	25	Y	IN	SUM	Yearly sum of principal payments, dollars.
SSALVG	R	C	25	Y	IN	SUM,TAX	Yearly sum of salvage value, dollars.
SSTDP	R	C	25	Y	IN	SUM	Yearly sum of straight-line depreciation, dollars.
STDEP	R	C	100	A	IN	DEPSUB	Straight line depreciation, dollars.
STLIFE	R	C				DEPSUB	Economic life for straight line depreciation, years.
SYNTRS	R	C	25	Y	IN	SUM	Yearly sum of interest payments, dollars.
SUM	R	C				DCFSUB	Total accumulated present value of cash flow, dollars.

Table A.4 (Continued)

VARIABLE NAME	TYPE[1]	VALUE MODE[2]	ARRAY DIMENSION	INDEXED PARAMETER[3]	COMMON BLOCK	DEFINING ROUTINE	DESCRIPTION
T	R	I				DIRECT	Time factor in engine labor cost equations.
TAP	R	C	17	ST		INDIR	Advertising and publicity expense (total), dollars.
TAS	R	C	17	ST		INDIR	Total aircraft servicing expense, dollars.
TB	R	C	17	ST		INDIR	Block time, hours.
TRS	R	C	17	ST		INDIR	Total reservation and sales expense, dollars.
TTS	R	C	17	ST		INDIR	Total traffic servicing expense, dollars.
TXRATE	R	A				INPUTS	Tax rate for income tax.
U	R	I				DIRECT INDIR	Annual utilization per aircraft in block hours.
VA	R	I				DIRECT	Airframe cost, dollars.
VE	R	I				DIRECT	Unit engine cost, dollars.
VT	R	C				DIRECT	Aircraft total cost, dollars.
WA	R	C				DIRECT	Airframe weight, pounds.
WEM	R	C				DIRECT	Aircraft empty weight, pounds.
WEN	R	C				DIRECT	Unit engine weight, pounds.
WGR	R	I				DIRECT	Gross vehicle weight, pounds.
XNAME	A	I	20	DI		DIRECT INDIR	Comment card label for output table headings.
YNTRST	R	C	25,100	Y,A		REPAY	Yearly interest payments, dollars.
YRPPAY	R	C	25,100	Y,A		REPAY	Yearly principal payment, dollars.

Table A.4 (Concluded)

[1] Type of variable classification:

- A = Alphanumeric
- I = Integer
- R = Real

[2] Value mode classifications:

- C = Value calculated in program
- I = Read from input file
- A = Value assigned in program
- LI = Loop index

[3] Indexed parameter for arrays:

- ST = Stage length
- A = Aircraft type
- Y = Number of years
- DI = Data items

Appendix B

DESCRIPTION OF PLOTTER SOFTWARE ROUTINES

Appendix B

DESCRIPTION OF PLOTTER SOFTWARE ROUTINES

The plotted output of the Fleet Accounting Module is generated on the ZETA PLOTTER 230, using a CDC 7600 computer. The plotter software used by the Fleet Accounting Module is described in this appendix. This software includes subroutines PLOT, SYMBOL, PLOTS, RSTR, LINAXS, and NUMBER. The descriptions provided here were extracted from internal NASA Ames documentation*. Listings of the source code for the routines are provided in Appendix C.

SUBROUTINE PLOT(X,Y,IPEN)

PLOT performs the basic plotting function of moving the pen from its current location to a specified location with the pen either up or down.

X,Y - The coordinates (in inches) of the point to which the pen is to be moved. The positive X direction is defined as parallel to the margin of the plotting paper and toward the clean roll (package) of paper (i.e., from left to right in the normal fashion as one stands alongside the plotter in the indicated position).

*L. C. Evans, "Memorandum for Systems Studies Divison Staff on Plotter Software," NASA-Ames MS:202-8, Moffett Field, California (April 1974).

IPEN - The magnitude of IPEN specifies the operation to be performed:

IPEN = 0 No change in pen position; present pen location is redefined as (X,Y).

= 1 Pen is moved to (X,Y) without raising or lowering the pen.

= 2 Pen is moved to (X,Y) with pen down.

= 3 Pen is moved to (X,Y) with pen up.

= 4 No pen movement; the current location of the pen is returned in (X,Y).

= 5 Initialization call; used by PLOTS.

= 6 Pen is moved to a new "page", the plotter buffer is dumped, and the pertinent parameters are re-initialized, readying the plot software either for termination of the program or for a new plot.

= 7 Used to change the plotting factor (if $X > 0$) or the plotter grain (if $X < 0$ and $Y > 0$); no operation if $X < 0$ and $Y < 0$. This value of IPEN should not be used unless the user is familiar enough with the coding of PLOT to understand what effects changes in these values will have.

= 8 Pen is raised but not moved.

= 9 Pen is lowered but not moved.

= 10 (not currently used).

= 11,12,13,14 Same as IPEN = 1,2,3,4, except that plot is offset, scaled, and rotated.

= 20 Same as OPEN = 13, except that pen position is saved.

= 21,22,23 Same as IPEN = 11,12,13, except that pen movement is calculated relative to the pen position saved from the last call to PLOT with IPEN = 20.

In the case of IPEN = -1,-2,-3,-11,-12,-13,-21,-22,-23, the action is the same as that described above, but after the new pen location has been reached, it is redefined as the origin.

SUBROUTINE SYMBOL(XLLHC,YLLHC,HEIGHT,BCD,ORIENT,NCHAR)

SYMBOL causes a string of alphanumeric information to be plotted.

XLLHC,YLLHC - For the purposes of visualization, each character can be thought of as being drawn inside a rectangle whose size is determined by the value of HEIGHT. The size of the rectangle is the same for all characters involved in a given call to SYMBOL. The value of (XLLHC,YLLHC) gives the coordinates of the lower left-hand corner of the rectangle associated with the first character to be plotted.

HEIGHT - The height of the characters (in inches). The width of each character, for the purposes of determining the length of a plotted character string, is 0.8*HEIGHT.

BCD - An array containing the character string to be plotted.

ORIENT - The orientation at which the string is to be plotted, measured CCW in degrees from the +X axis.

NCHAR - The number of characters to be plotted. If NCHAR is less than zero, one of a series of plotting symbols is drawn <u>centered</u> on the point given by (XLLHC,YLLHC). Fifteen symbols are available, and the one drawn is determined by the absolute value of NCHAR (taken <u>modulo</u> 15) according to:

-NCHAR	Plotting Symbol
1	square
2	circle
3	triangle
4	cross ("plus" sign)
5	cross ("X")
6	diamond
7	tilted hourglass
8	upside-down teepee
9	Z
10	Y
11	lozenge
12	asterisk (comb. of 4 & 5)
13	hourglass
14	vertical line
15	star

The standard character set, as represented by the symbols on the 029 keyboard, is available through SYMBOL, with the exception of the following nine symbols: _,|,',@,¬,&,¢,#,0-8-2.

SUBROUTINE PLOTS(LUN)

PLOTS performs all of the necessary initialization for the plotting software. It should be called prior to calling any other routine in the package.

LUN - Logical unit number. In addition to transmitting this information to the plotting routines, a tape of this number must be declared in the user's PROGRAM statement.

SUBROUTINE RSTR(IARG)

RSTR generates the call CALL PLOT(0.,0.,6) in order to clear the plotting buffers and move to a new page.

IARG - A dummy argument; it is ignored.

```
SUBROUTINE LINAXS(XO,YO,X1,Y1,LABSIZ,WHICH,NTIC,NLFREQ,VALO,VALMAX,
     NDIGIT,NLABEL,LABEL)
```

LINAXS plots and labels a linear axis.

XO - X coordinate of the left-hand edge of the plot in inches.

YO - Y coordinate of the lower edge of the plot in inches.

X1 - X coordinate of the right-hand edge of the plot in inches.

Y1 - Y coordinate of the upper edge of the plot in inches.

LABSIZ - (REAL) Size of the labels in inches.

WHICH - (INTEGER) Indicates whether a horizontal or vertical axis is to be plotted:

WHICH = +1 vertical
      = -1 horizontal

NTIC - Number of tick marks, including one at the end of the axis. This is also, therefore the number of intervals into which the tick marks divide the axis.

NLFREQ - Frequency with which tick marks are to be labeled.

VALO - Value of the axis variable at the beginning of the axis.

VALMAX - Value of the axis variable at the end of the axis.

NDIGIT - Number of significant digits to be used in writing tick mark labels.

NLABEL - Number of characters in axis label.

LABEL - Array containing the axis label.

SUBROUTINE NUMBER(XLLHC,YLLHC,HEIGHT,A,ORIENT,N)

NUMBER converts a number to its EBCDIC representation and plots it.

XLLHC,YLLHC - The coordinates in inches of the lower left-hand corner of the character string to be plotted. (See the write-up for SYMBOL for a more complete explanation.)

HEIGHT - The height in inches of the number on the plot.

A - The number which is to be converted and plotted; is considered to be an array if N is a FORMAT.

ORIENT - The orientation at which he number is to be plotted.

N - If the absolute value of N is less than 20, then the value of N is the number of decimal places to be included. If the absolute value of N is not less than 20, then N is assumed to be an array containing the FORMAT with which the number(s) in A are to be plotted. If N contains a format, then the element of the array following the end of the format must contain all EBCDIC blanks, and the next word must contain the number of values in the array A which are to be written. The character string generated by the format must be no more than 1000 characters long and must be terminated by an "@" symbol.

If HEIGHT is less than zero, (XLLHC,YLLHC) is assumed to specify the lower right-hand corner of the last character to be plotted.

Appendix C

LISTING OF PROGRAM SOURCE CODE FOR THE FLEET ACCOUNTING MODULE

```
      PROGRAM RET (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,
     * TAPE2,TAPE4,TAPE7,TAPE8,TAPE9,TAPE11)
C
C     RET IS THE MAJOR COMPONENT IN THE FLEET ACCOUNTING MODULE OF THE
C     ARC-ART MODELS.  THE BASIC FUNCTION OF THIS MODULE IS TO PROJECT
C     THE FLEET COMPOSITION NECESSARY TO MEET TRAFFIC DEMAND.  RET ALSO
C     IS USED TO DRIVE THE AIRFRAME MANUFACTURER MODULE.
C
      DIMENSION TYPE(10),YRINTRO(10),SEATS(10),SFC(10),SPEED(10),
     XUTILIZ(10),LIFETIM(10),PLOTS(10)
      DIMENSION LF(31)
      DIMENSION GROWTH(31),MARKET(31)
      DIMENSION MODATA(7),NOBUYS(10,46),NORETIR(10,46)
      DIMENSION MTYPE(10),MODYR(10),MSEATS(10),MSFC(10),MSPEED(10),
     XMUTILIZ(10),MLIFET(10)
      DIMENSION SEATMI(10,31),FUELBRN(10,31),RPM(10,31),POPUL(10,31)
      DIMENSION TOTLMIS(31),TOTLFLB(31),TOTLRPM(31),TOTLPOP(31)
      DIMENSION SHRSMIS(3,31),SHRFUEL(3,31),SHRRPMS(3,31),SHRPOPL(3,31)
      DIMENSION TOTLBUY(31),TOTLRTR(31)
      DIMENSION MRKTYPE(3)
      DIMENSION SHRBUYS(3,31),SHRETIR(3,31)
      DIMENSION PLTRPMS(3),PLTFUEL(3)
      DOUBLE PRECISION MRKTYPE
      REAL NOBUYS,NORETIR,NOBYS,NORTR
      COMMON /MARKET/ MARKET
      COMMON /STATIST/ TYPE,YRINTRO,SEATS,SFC,SPEED,UTILIZ,LF,LIFETIM
     *,PLOTS
      COMMON /MODS/ MTYPE,MODYR,MSEATS,MSFC,MSPEED,MUTILIZ,MLIFET
      COMMON /RESULTS/ SEATMI,FUELBRN,RPM
      COMMON /POP/ NOBUYS,NORETIR,POPUL
      COMMON /INDICES/ NIEXPLS,IN,OUT
      COMMON /SHARES/ SHRSMIS,SHRFUEL,SHRRPMS,SHRPOPL,SHRBUYS,SHRETIR
      COMMON /TOTALS/ SMILES,FBURNED,RPMS,POPULNO,NOBYS,NORTR
      COMMON /ACCUMS/ TOTLMIS,TOTLFLB,TOTLRPM,TOTLPOP,TOTLBUY,TOTLRTR
      COMMON /STARTER/ NOCRVS,MRKTYPE,D1,D2,PLTRPMS,PLTFUEL,PERCENT
      INTEGER YEAR,YR
      INTEGER IN,OUT
      REAL LF,LIFETIM,MARKET,MODATA
      REAL MTYPE,MODYR,MSEATS,MSFC,MSPEED,MUTILIZ,MLIFET
C
C     SET UP IDENTIFICATION OF LOGICAL UNITS FOR PLOTTING ROUTINES
C
      LUN=9
      LUN11=11
      REWIND LUN
      REWIND LUN11
      CALL UNIT,4
      CALL SETUP(LUN11)
      NOCRVS=0
      MRKT=1
      GO TO 96
   95 CONTINUE
      MRKT=MRKT+1
   96 CONTINUE
      DO 15 I=1,10
      MTYPE(I)=0.0
   15 CONTINUE
```

```
      C
      C     READ MARKET NAME
      C
            READ (5,8) MRKTYPE(MRKT)
      8     FORMAT (2A10)
            IF (EOF(5)) 999,94
      94    CONTINUE
            WRITE (6,7) MRKTYPE(MRKT)
      7     FORMAT (1H1,T50,*MARKET = *,2A10)
      C
      C     READ RPM GROWTH RATES FOR EACH YEAR FROM 1975-2005
      C
            READ (5,1) GROWTH
      1     FORMAT (8F10.0)
            IF (EOF(5)) 999,97
      97    CONTINUE
            WRITE (6,11)
      11    FORMAT(1H0,*GROWTH*)
            WRITE (6,5) GROWTH
      5     FORMAT(1X,8F10.4)
            PERCENT=GROWTH(1)
      C
      C     READ LOAD FACTOR FOR EACH YEAR FROM 1975-2005
      C
            READ (5,1) LF
            IF (EOF(5)) 999,93
      93    CONTINUE
            WRITE (6,13)
      13    FORMAT(1H0,* LF *)
            WRITE (6,5) LF
      *
      C
      C     READ IN PARAMETERS DEFINING EXISTING AIRCRAFT CURRENTLY IN SERVICE
      C
      *
            READ (5,2) NOEXPLS
      2     FORMAT(I5)
            IF (EOF(5)) 999,98
      98    CONTINUE
            WRITE (6,12)
      12    FORMAT(* EXISTING FLEET *)
            WRITE (6,2) NOEXPLS
            DO 10 I=1,NOEXPLS
            READ (5,3) TYPE(I),YRINTRO(I),SEATS(I),SFC(I),SPEED(I),UTILIZ(I),
           X                LIFETIM(I),PLOTS(I)
      3     FORMAT(A10,6F10.0,A10)
            IF (EOF(5)) 999,99
      99    CONTINUE
            WRITE (6,6) TYPE(I),YRINTRO(I),SEATS(I),SFC(I),SPEED(I),UTILIZ(I),
           X                LIFETIM(I),PLOTS(I)
      6     FORMAT(1X,A10,6F10.4,A10)
      C
      C     CONVERT FUEL BURNED FROM POUNDS PER SEAT MILE TO BARRELS PER
      C     SEAT MILE
      C
            SFC(I)=SFC(I)/281.4
      *
```

```
C     READ IN PAST 10 YEAR HISTORY OF BUYS AND RETIREMENTS              RET    116
C     OF EXISTING AIRCRAFT                                              RET    117
*                                                                       RET    118
      READ (5,4) (NOBUYS(I,J),J=1,15,1)                                 RET    119
    4 FORMAT(8F10.0)                                                    RET    120
      IF (EOF(5)) 999,101                                               RET    121
  101 CONTINUE                                                          RET    122
      WRITE (6,5) (NOBUYS(I,J),J=1,15,1)                                RET    123
      READ (5,4) (NORETIR(I,J),J=1,16,1)                                RET    124
      IF (EOF(5)) 999,9                                                 RET    125
    9 CONTINUE                                                          RET    126
      WRITE (6,5) (NORETIR(I,J),J=1,16,1)                               RET    127
   11 CONTINUE                                                          RET    128
C                                                                       RET    129
C     READ DATA DEFINING FUTURE MODIFICATIONS TO EXISTING AIRCRAFT      RET    130
C     TYPES                                                             RET    131
C                                                                       RET    132
      READ (5,2) NOMODS                                                 RET    133
      IF (EOF(5)) 999,102                                               RET    134
  102 CONTINUE                                                          RET    135
      WRITE (6,25)                                                      RET    136
   26 FORMAT(* MODIFICATIONS *)                                         RET    137
      WRITE (6,2) NOMODS                                                RET    138
C                                                                       RET    139
C     CHECK TO SEE IF THERE ARE ANY MODIFICATIONS TO BE MADE TO THE     RET    140
C     EXISTING AIRCRAFT                                                 RET    141
C                                                                       RET    142
      IF (NOMODS.EQ.0)  GO TO 35                                        RET    143
      DO 30 J=1,NOMODS                                                  RET    144
      READ (5,3) MODATA                                                 RET    145
      IF (EOF(5)) 999,103                                               RET    146
  103 CONTINUE                                                          RET    147
      WRITE (6,6) MODATA                                                RET    148
      NAME=SHIFT(MODATA(1),6)                                           RET    149
      NAME=NAME.OR.COLCOOOOOOOOOOO0000558                               RET    150
      DO 20 I=1,NOEXPLS                                                 RET    151
      IF (NAME.NE.TYPE(I))  GO TO 20                                    RET    152
      IT=I                                                              RET    153
      GO TO 25                                                          RET    154
   20 CONTINUE                                                          RET    155
   25 CONTINUE                                                          RET    156
      MTYPE  (IT)=MODATA(1)                                             RET    157
      MODYR  (IT)=MODATA(2)                                             RET    158
      MSEATS (IT)=MODATA(3)                                             RET    159
      MSFC   (IT)=MODATA(4)/281.4                                       RET    160
      MSPEED (IT)=MODATA(5)                                             RET    161
      MUTILIZ(IT)=MODATA(6)                                             RET    162
      MLIFET (IT)=MODATA(7)                                             RET    163
   30 CONTINUE                                                          RET    164
   35 CONTINUE                                                          RET    165
*                                                                       RET    166
C     READ PARAMETERS DEFINING NEW AIRCRAFT TO BE ENTERED INTO SERVICE  RET    167
*                                                                       RET    168
      OUT=NOEXPLS                                                       RET    169
      READ (5,2) NONEW                                                  RET    170
      IF (EOF(5)) 999,37                                                RET    171
   37 CONTINUE                                                          RET    172
```

```
      WRITE (6,41)
   41 FORMAT(* NEW AIRCRAFT TYPES *)
      WRITE (6,2) NONEW
      IN=NOEXPLS+1
      OUT=NOEXPLS+NONEW
      IF (NONEW.EQ.0) GO TO 45
      DO 40 I=IN,OUT,1
      READ (5,3) TYPE(I),YRINTRO(I),SEATS(I),SFC(I),SPEED(I),UTILIZ(I),
     *           LIFETIM(I),PLOTS(I)
      IF (EOF(5)) 999,104
  104 CONTINUE
      WRITE (6,6) TYPE(I),YRINTRO(I),SEATS(I),SFC(I),SPEED(I),UTILIZ(I),
     *           LIFETIM(I),PLOTS(I)
      SFC(I)=SFC(I)/281.4
      DO 38 J=1,16
      NOBUYS(I,J)=0.0
      NORETIR(I,J)=0.0
   38 CONTINUE
   40 CONTINUE
   45 CONTINUE
*
C     FROM INPUT BUY AND RETIREMENT HISTORY, COMPUTE AIRCRAFT
C     POPULATION BY TYPE IN BASE YEAR
*
      DO 55 I=1,NOEXPLS
      POPUL(I,1)=0.0
      DO 55 J=1,16,1
      POPUL(I,1)=POPUL(I,1)+NOBUYS(I,J)-NORETIR(I,J)
   55 CONTINUE
*
*     COMPUTE SEAT-MILES/YR/PLANE, REVENUE-PASSENGER MILES/YR/PLANE
*     AND FUEL-BURNED/YR/PLANE FOR BASE YEAR 1975.
*
      DO 50 I=1,NOEXPLS
      SEATMI(I,1)=SPEED(I)*UTILIZ(I)*SEATS(I)
      RPM(I,1)=SEATMI(I)*LF(1)
      FUELBRN(I,1)=SFC(I)*SEATMI(I,1)
   50 CONTINUE
*
*     COMPUTE RPMS GENERATED FOR BASE YEAR 1975
*
      DO 57 I=IN,OUT,1
      POPUL(I,1)=0.0
   57 CONTINUE
      MARKET(1)=0.0
      DO 60 I=1,NOEXPLS
      MARKET(1)=MARKET(1)+RPM(I,1)*POPUL(I,1)
   60 CONTINUE
*
C     COMPUTE PROJECTED RPMS DEMANDED IN FUTURE YEARS (1975-2005)
*
      DO 70 I=2,31
      MARKET(I)=(1.+GROWTH(I)*.01)*MARKET(I-1)
   70 CONTINUE
      WRITE (6,71)
   71 FORMAT(* MARKET *)
      WRITE (6,72) MARKET
```

```
      76   FORMAT(1X,4E30.20)
C
C          PROJECT FLEET COMPOSITION FOR EACH YEAR BY DETERMINING
C          RETIREMENTS, MODIFICATIONS, AND BUYS
C
           DO 200 YEAR=1976,2005,1
           YR=YEAR-1974
C
C          ADJUST POPULATION OF EXISTING AIRCRAFTS ACCORDING TO THEIR
C          LIFE-CYCLE
C
           CALL AMORTIZ (YR)
C
C          CHECK FOR WHETHER MODIFICATION ARE TO BE MADE TO ANY EXISTING
C          AIRCRAFT TYPES
C
           CALL MODS (YR)
C
C          DETERMINE NEW AIRCRAFT NEEDED TO MEET DEMAND
C
C
           CALL BUYS (YR)
C
     200   CONTINUE
C
C          PRINT FOR EACH AIRCRAFT TYPE YEARLY VALUES FOR SEAT MILES
C          FLOWN, FUEL BURNED, RPMS FLOWN, AIRCRAFT POPULATION, BUYS,
C          AND RETIREMENTS
C
           DO 400 I=1,OUT,1
           WRITE (6,201) TYPE(I)
     201   FORMAT(1H1,T50,* AIRCRAFT TYPE = *,A10)
           WRITE (6,299)
     299   FORMAT(1H0,* YEAR *,T23,*SEAT-MILES*,T40,*FUELBURNED*,T63,
          X *RPMS*,T80,*POPULATION*,T101,*# BUYS/YR*,T120,*# RETIRED/YR*)
           WRITE (6,298)
     298   FORMAT(T22,*(YEAR)*,T42,*(YEAR)*,T62,*(YEAR)*,T78,*AS OF MID-YEAR*
          X,T98,*(THRU MID-YEAR)*,T118,*(THRU MID-YEAR)*/)
           DO 300 YEAR=1975,2005,1
           YR=YEAR-1974
           SMILES=SEATMI(I,YR)*POPUL(I,YR)
           FBURNED=FUELRPN(I,YR)*POPUL(I,YR)
           RPMS=RPM(I,YR)*POPUL(I,YR)
           POPULNO=POPUL(I,YR)
           NOBYS=NOBUYS(I,15+YR)
           NORTR=NORETIR(I,15+YR)
           WRITE (6,301) YEAR,SMILES,FBURNED,RPMS,POPULNO,NOBYS,NORTR
     301   FORMAT (I6,12X,5(E10.4,10X),E10.4)
           CALL SHARE (MRKT,YR)
     300   CONTINUE
C
C          CALL SUBROUTINE CURVES TO STORE DATA FOR LATER PLOTTING
C          (SUBROUTINE PLOTTER)
C
           CALL CURVES
     400   CONTINUE
           IF (NONEW.EQ.0) GO TO 410
```

```
      C
      C     SUBROUTINE INPLANT IS THE INTERFACE WITH THE AIRFRAME
      C     MANUFACTURER MODULE WHICH ESTIMATES THE AIRCRAFT MANUFACTURING
      C     RATES OF RETURN ON INVESTMENT
      C
            CALL INPLANT
      410   CONTINUE
            PLTRPMS(MRKT)=SHRRPMS(MRKT,31)
            PLTFUEL(MRKT)=SHRFUEL(MRKT,31)
            CALL PLOTSGL (MRKT)
      C
      C     FOR EACH AIRCRAFT TYPE BY YEAR, PRINT CUMULATIVE VALUES FOR
      C     SEAT MILES FLOWN, FUEL CONSUMED, RPMS FLOWN, BUYS, AND
      C     RETIREMENTS
      C
            DO 440 I=1,OUT,1
            SMILES =0.0
            FBURNED=0.0
            RPMS   =0.0
            POPULNO=0.0
            BUY=0.0
            RETIR=0.0
            WRITE (6,200) TYPE(I)
            WRITE (6,451)
            DO 435 YEAR=1975,2005,1
            YR=YEAR-1974
            SMILES = SMILES+SEATMI(I,YR)*POPUL(I,YR)
            FBURNED = FBURNED+FUELBRN(I,YR)*POPUL(I,YR)
            RPMS = RPMS+RPM(I,YR)*POPUL(I,YR)
            BUY=BUY+NOBUYS(I,15+YR)
            RETIR=RETIR+NORETIR(I,15+YR)
            WRITE (6,452) YEAR,SMILES,FBURNED,RPMS,BUY,RETIR
      435   CONTINUE
      440   CONTINUE
      C
      C     GO CONSIDER NEXT MARKET
      C
            GO TO 95
      999   CONTINUE
            MRKT=MRKT-1
      C
      C     PRINT CUMULATIVE FLEET COMPOSITION AND ACTIVITY PROJECTS FOR
      C     EACH MARKET
      C
            DO 450 I=1,MRKT
            SMILES =0.0
            FBURNED=0.0
            RPMS   =0.0
            BUY=0.0
            RETIR=0.0
            WRITE (6,601) MRKTYPE(I)
            WRITE (6,451)
      451   FORMAT(//T10,*YEAR*,T22,*ACCUMULATIVE*,T44,*ACCUMULATIVE*,T65,
           X*ACCUMULATIVE*,T88,*ACCUMULATIVE*,T110,*ACCUMULATIVE*,
           X/T22,* SEAT-MILES*,T44,*FUEL-BURNED*,T66,*    RPMS*,T89,*  = BUYS*
           X,T110,* = RETIRED*)
            WRITE (6,449)
```

```
  449 FORMAT(T21,*(TO END OF YEAR)*,T43,*(TO END OF YEAR)*,
     X,T65,*(TO END OF YEAR)*,T87,*(THRU MID-YEAR)*,
     XT109,*(THRU MID-YEAR)*/)
      DO 430 YEAR=1975,2005,1
      YR=YEAR-1974
      SMILES = SMILES+SHRSMIS(I,YR)
      FBURNED=FBURNED+SHRFUEL(I,YR)
      RPMS   = RPMS  +SHRRPMS(I,YR)
      BUY=BUY+SHRBUYS(I,YR)
      RETIR=RETIR+SHRETIR(I,YR)
      WRITE (6,452) YEAR, SMILES, FBURNED, RPMS, BUY, RETIR
  452 FORMAT(I13,T20,E12.4,T42,E12.4,T64,E12.4,T86,E12.4,T10?,E12.4)
  430 CONTINUE
  450 CONTINUE
      SMILES =0.0
      FBURNED=0.0
      RPMS   =0.0
      BUY=0.0
      RETIR=0.0
      WRITE (6,481)
  481 FORMAT(1H1,T45,*ACCUMULATIVE TOTALS FOR ALL MARKETS*)
      WRITE (6,451)
      WRITE (6,449)
C
C     PRINT TOTAL CUMULATIVE FLEET COMPOSITION AND ACTIVITY
C     PROJECTIONS FOR ALL MARKETS
C
      DO 480 YEAR=1975,2005,1
      YR=YEAR-1974
      DO 460 I=1,MRKT
      SMILES = SMILES+SHRSMIS(I,YR)
      FBURNED=FBURNED+SHRFUEL(I,YR)
      RPMS   = RPMS  + SHRRPMS(I,YR)
      BUY=BUY+SHRBUYS(I,YR)
      RETIR=RETIR+SHRETIR(I,YR)
  460 CONTINUE
      WRITE (6,452) YEAR, SMILES, FBURNED, RPMS, BUY, RETIR
  480 CONTINUE
C
C     PRINT FRACTIONAL MARKET SHARE OF CUMULATIVE FLEET COMPOSITION
C     AND ACTIVITY PROJECTIONS FOR EACH MARKET
C
      DO 600 I=1,MRKT
      WRITE (6,601) MRKTYPE(I)
  601 FORMAT(1H1,T52,*MARKET = *,2A10)
      WRITE (6,502)
  602 FORMAT(//T11,*YEAR*,T25,*FRACTIONAL*,T55,*FRACTIONAL*,T85,*FRACTIO
     XNAL*,T115,*FRACTIONAL*,           /T25,*SEAT-MILES*,T55,*FUEL-BU
     XRNED*,T88,*RPMS*,T115,*POPULATION*/)
      DO 500 YEAR=1975,2005,1
      YR=YEAR-1974
      FCTSMIS = SHRSMIS(I,YR)/TOTLMIS(YR)
      FCTFUEL = SHRFUEL(I,YR)/TOTLFLB(YR)
      FCTRPMS = SHRRPMS(I,YR)/TOTLRPM(YR)
      FCTPOPL = SHRPOPL(I,YR)/TOTLPOP(YR)
      WRITE (6,501) YEAR,FCTSMIS,FCTFUEL,FCTRPMS,FCTPOPL
  501 FORMAT(I14,4(E20.4,10X))
```

```
  500 CONTINUE
  600 CONTINUE
C
C     PRINT YEARLY FLEET COMPOSITION AND ACTIVITY PROJECTIONS FOR
C     EACH MARKET
C
      DO 700 I=1,MRKT
      WRITE (6,501) MRKTYPE(I)
      WRITE (6,299)
      WRITE (6,298)
      DO 650 YEAR=1975,2005,1
      YR=YEAR-1974
      WRITE (6,301) YEAR,SHRSMIS(I,YR),SHRFUEL(I,YR),SHRRPMS(I,YR),
     X                   SHRPOPL(I,YR),SHRBUYS(I,YR),SHRETIR(I,YR)
  650 CONTINUE
  700 CONTINUE
      WRITE (6,801)
  801 FORMAT(1H1,T50,*TOTALS FOR ALL MARKETS*)
      WRITE (6,299)
      WRITE (6,298)
C
C     PRINT TOTAL YEARLY FLEET COMPOSITION AND ACTIVITY PROJECTIONS
C     FOR ALL MARKETS
C
      DO 800 YEAR=1975,2005,1
      YR=YEAR-1974
      WRITE (6,301) YEAR,TOTLMIS(YR),TOTLFLR(YR),TOTLRPM(YR),TOTLPOP(YR)
     X,            TOTLBUY(YR),TOTLRTR(YR)
  800 CONTINUE
C
C     CALL SUBROUTINE PLOTTER TO PLOT TOTALS FOR MARKETS
C
      OPLOT=1
      READ(5,2) OPLOT
      IF(OPLOT.EQ.0) STOP
      CALL PLOTTER (LUN)
      STOP
      END
```

```
      SUBROUTINE AMORTIZ (YR)
C
C     THIS SUBROUTINE RETIRES AIRCRAFT THAT HAVE REACHED
C     RETIREMENT AGE
C
      DIMENSION TYPE(10),YRINTRO(10),SEATS(10),SEC(10),SPEED(10),
     X UTILIZ(10),LIFETIM(10)
      DIMENSION POPUL(10,31),NOBUYS(10,46),NORETIR(10,46)
      DIMENSION PLOTS(10)
      DIMENSION LF(31)
      INTEGER YR,OUT,DYEAR,PASS
      REAL LF,LIFETIM,NOBUYS,NORETIR
      COMMON /STATIST/ TYPE,YRINTRO,SEATS,SEC,SPEED,UTILIZ,LF,LIFETIM
     *,PLOTS
      COMMON /POP/ NOBUYS,NORETIR,POPUL
      COMMON /INDICES/ NOEXPLS,IN,OUT
C
C     INITIALIZE BUY AND RETIREMENT COUNTS FOR CURRENT YEAR TO ZERO
C
      DO 5 I=1,OUT
      NOBUYS(I,15+YR)=0.0
      NORETIR(I,15+YR)=0.0
    5 CONTINUE
      DO 30 I=1,OUT
C
C     FIND THE PAST YEAR SUCH THAT AIRCRAFT BOUGHT IN THAT YEAR HAVE
C     REACHED RETIREMENT AGE, RETIRE THOSE AIRCRAFT
C
      DYEAR=15+YR-LIFETIM(I)
      IF (DYEAR.LE.0)  GO TO 15
      NORETIR(I,15+YR)=NOBUYS(I,DYEAR)
   15 CONTINUE
      POPUL(I,YR)=POPUL(I,YR-1)-NORETIR(I,15+YR)
      IF (POPUL(I,YR).LE.0.0)  POPUL(I,YR)=0.0
      IF ((POPUL(I,YR-1).EQ.0.0).AND.(POPUL(I,YR).EQ.0.0))
     X   NORETIR(I,15+YR)=0.0
   30 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE MODS (YR)
C
C     THIS SUBROUTINE MODIFIES AIRCRAFT CURRENTLY IN THE FLEET
C     THAT ARE SCHEDULED FOR MODIFICATION
C
      DIMENSION TYPE(10),YRINTRO(10),SEATS(10),SFC(10),SPEED(10),
     X UTILIZ(10),LIFETIM(10)
      DIMENSION LF(31)
      DIMENSION MTYPE(10),MODYR(10),MSEATS(10),MSFC(10),MSPEED(10),
     X MUTILIZ(10),MLIFET(10)
      DIMENSION SEATMI(10,31),FUELBRN(10,31),RPM(10,31)
      DIMENSION  PLOTS(10)
      INTEGER YR,OUT
      REAL LF,LIFETIM,MTYPE,MODYR,MSEATS,MSFC,MSPEED,MUTILIZ,MLIFET
      COMMON /STATIST/ TYPE,YRINTRO,SEATS,SFC,SPEED,UTILIZ,LF,LIFETIM
     *,PLOTS
      COMMON /MODS/ MTYPE,MODYR,MSEATS,MSFC,MSPEED,MUTILIZ,MLIFET
      COMMON /RESULTS/ SEATMI,FUELBRN,RPM
      COMMON /INDICES/ NOFXPLS,IN,OUT
      YEAR=YR+1974.
C
C     CHECK EACH EXISTING AIRCRAFT FOR POSSIBLE MODIFICATION
C
      DO 200 I=1,NOFXPLS
      IF (MTYPE(I).EQ.0.0)  GO TO 200
      IF (MODYR(I).NE.YEAR)  GO TO 100
C
C     IN THE YEAR MODIFICATION BEGINS, LET THE AIRCRAFT PARAMETER
C     VALUES EQUAL THE AVERAGE OF THE ORIGINAL AND MODIFIED VALUES
C
      IF (MSEATS(I).EQ.0.0)  GO TO 10
      SEATS(I)=(SEATS(I)+MSEATS(I))/2.
   10 CONTINUE
      IF (MSFC(I).EQ.0.0)  GO TO 20
      SFC(I)=(SFC(I)+MSFC(I))/2.
   20 CONTINUE
      IF (MSPEED(I).EQ.0.0)  GO TO 30
      SPEED(I)=(SPEED(I)+MSPEED(I))/2.
   30 CONTINUE
      IF (MUTILIZ(I).EQ.0.0)  GO TO 40
      UTILIZ(I)=(UTILIZ(I)+MUTILIZ(I))/2.
   40 CONTINUE
      IF (MLIFET(I).EQ.0.0)  GO TO 100
      LIFETIM(I)=(LIFETIM(I)+MLIFET(I))/2.
  100 CONTINUE
      IF (MODYR(I)+1.NE.YEAR)  GO TO 200
C
C     IN THE YEAR AFTER MODIFICATION BEGINS, THE AIRCRAFT PARAMETER
C     VALUES TAKE ON THE MODIFIED VALUES
C
      IF (MSEATS(I).EQ.0.0)  GO TO 110
      SEATS(I)=MSEATS(I)
  110 CONTINUE
      IF (MSFC(I).EQ.0.0)  GO TO 120
      SFC(I)=MSFC(I)
  120 CONTINUE
      IF (MSPEED(I).EQ.0.0)  GO TO 130
```

```
      SPEED(I)=MSPEED(I)
  130 CONTINUE
      IF (MUTILIZ(I).EQ.0.0)  GO TO 140
      UTILIZ(I)=MUTILIZ(I)
  140 CONTINUE
      IF (MLIFET(I).EQ.0.0)  GO TO 200
      LIFETIM(I)=MLIFET(I)
  200 CONTINUE
C
C     COMPUTE SEAT MILES, RPMS, AND FUEL BURN PER AIRCRAFT OF EACH
C     TYPE FOR THE CURRENT YEAR
C
      DO 300 I=1,OUT
      SEATMI(I,YR)=SPEED(I)*UTILIZ(I)*SEATS(I)
      RPM(I,YR)=SEATMI(I,YR)*LF(YR)
      FUELBRN(I,YR)=SFC(I)*SEATMI(I,YR)
  300 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE BUYS (YR)
C
C     THIS SUBROUTINE COMPUTES THE NUMBER OF RPMS DEMANDED, AND THE
C     NUMBER OF RPMS THAT CAN BE GENERATED BY THE CURRENT FLEET, AND
C     IF CURRENT FLEET DOES NOT MEET THE DEMAND, PURCHASES THE
C     ADDITIONAL AIRCRAFT REQUIRED
C
      INTEGER YR,IN,OUT,YEAR
      DIMENSION TYPE(10),YRINTRO(10),SEATS(10),SFC(10),SPEED(10),
     * UTILIZ(10),LIFETIM(10)
      DIMENSION LF(31)
      DIMENSION PLOTS(1.)
      DIMENSION MARKET(31)
      DIMENSION NOBUYS(10,46),NORETIR(10,46)
      DIMENSION SEATMI(10,31),FUELBRN(10,31),RPM(10,31),POPUL(10,31)
      REAL MARKET,LF,LIFETIM,LOADFCT,NOBUYS,NORETIR
      COMMON /STATIST/ TYPE,YRINTRO,SEATS,SFC,SPEED,UTILIZ,LF,LIFETIM
     *,PLOTS
      COMMON /RESULTS/ SEATMI,FUELBRN,RPM
      COMMON /MARKET/ MARKET
      COMMON /INDICES/ NOFXPLS,IN,OUT
      COMMON /POP/ NOBUYS,NORETIR,POPUL
      TOTAL=0.0
C
C     COMPUTE TOTAL RPMS AVAILABLE FOR THIS YEAR
C
      DO 100 I=1,OUT
      TOTAL=TOTAL+RPM(I,YR)*POPUL(I,YR)
100   CONTINUE
C
C     COMPUTE DIFFERENCE BETWEEN DEMANDED AND AVAILABLE RPMS
C
      RPMDIFF=MARKET(YR)-TOTAL
      IF (RPMDIFF.LT.0.0)  GO TO 999
      YEAR=YR+1974.
C
C     DETERMINE WHICH TYPE OF AIRCRAFT IS TO BE PURCHASED
C
      DO 200 I=1,OUT,1
      J=OUT-I+1
      IF ((YRINTRO(J).GT.YEAR).OR.(YRINTRO(J).EQ.0.0))  GO TO 200
      IT=J
      GO TO 300
200   CONTINUE
      RETURN
300   CONTINUE
C
C     ADJUST POPULATION TO ACCOUNT FOR BUYS
C
      NOBUYS(IT,15+YR)=RPMDIFF/RPM(IT,YR)
      POPUL(IT,YR)=POPUL(IT,YR)+NOBUYS(IT,15+YR)
      IF (POPUL(IT,YR).LT.0.0)  POPUL(IT,YR)=0.0
      RETURN
999   CONTINUE
C
C     COMPUTE ACTUAL LOAD FACTOR FOR THE CASE OF OVER SUPPLY OF
C     SEAT MILES
```

```
      C                                                                 BUYS      49
            LOADFCT=MARKET(YR)/TOTAL                                    BUYS      50
            YEAR=YR+1974                                                BUYS      51
            WRITE (5,1) LOADFCT,YEAR                                    BUYS      52
      1     FORMAT(* LF = *,F5.3,* WILL SATISFIED RPM REQUIREMENT FOR YEAR *,  BUYS      53
           XI5)                                                         BUYS      54
            RETURN                                                      BUYS      55
            END                                                         BUYS      56
```

```
      SUBROUTINE SHARE (MRKT,YR)
C
C     THIS SUBROUTINE STORES MARKET SHARE RESULTS FOR FLEET COMPOSITION
C     AND ACTIVITY STATISTIC
C
      INTEGER MRKT,YR
      DIMENSION TOTLMIS(31),TOTLFLB(31),TOTLRPM(31),TOTLPOP(31)
      DIMENSION TOTLBUY(31),TOTLRTR(31)
      DIMENSION SHRSMIS(3,31),SHRFUEL(3,31),SHRRPMS(3,31),SHRPOPL(3,31)
      DIMENSION SHRBUYS(3,31),SHRETIR(3,31)
      REAL NOBYS,NORTR
      COMMON /SHARES/ SHRSMIS,SHRFUEL,SHRRPMS,SHRPOPL,SHRBUYS,SHRETIR
      COMMON /TOTALS/ SMILES,FBURNED,RPMS,POPULNO,NOBYS,NORTR
      COMMON /ACCUMS/ TOTLMIS,TOTLFLB,TOTLRPM,TOTLPOP,TOTLBUY,TOTLRTR
C
C     UPDATE COUNT BY MARKET AND YEAR OF THE SEAT MILES FLOWN, FUEL
C     BURNED, RPMS FLOWN, ARICRAFT POPULATION, BUYS, AND RETIREMENTS
C
      SHRSMIS(MRKT,YR) = SHRSMIS(MRKT,YR)+SMILES
      SHRFUEL(MRKT,YR) = SHRFUEL(MRKT,YR)+FBURNED
      SHRRPMS(MRKT,YR) = SHRRPMS(MRKT,YR)+RPMS
      SHRPOPL(MRKT,YR) = SHRPOPL(MRKT,YR)+POPULNO
      SHRBUYS(MRKT,YR)=SHRBUYS(MRKT,YR)+NOBYS
      SHRETIR(MRKT,YR)=SHRETIR(MRKT,YR)+NORTR
C
C     UPDATE COUNT OF OVERALL TOTAL OF SEAT MILES FLOWN, FUEL BURNED,
C     RPMS FLOWN, AIRCRAFT POPULATION, BUYS, AND RETIREMENTS
C
      TOTLMIS(YR) = TOTLMIS(YR)+SMILES
      TOTLFLB(YR) = TOTLFLB(YR)+FBURNED
      TOTLRPM(YR) = TOTLRPM(YR)+RPMS
      TOTLPOP(YR) = TOTLPOP(YR)+POPULNO
      TOTLBUY(YR) = TOTLBUY(YR)+NOBYS
      TOTLRTR(YR) = TOTLRTR(YR)+NORTR
      RETURN
      END
```

```
      SUBROUTINE CURVES                                            CURVES     2
C                                                                  CURVES     3
C     THIS SUBROUTINE SETS UP REVENUE PASSENGER MILES AND FUEL     CURVES     4
C     CONSUMPTION DATA FOR PLOTTING                                CURVES     5
C                                                                  CURVES     6
      INTEGER YRNO                                                 CURVES     7
      DIMENSION TOTLMIS(31),TOTLFLB(31),TOTLRPM(31),TOTLPOP(31)    CURVES     8
      DIMENSION RPMS(30,31),FUELBRN(30,31),DUMMY(15)               CURVES     9
      DIMENSION TOTLBUY(31),TOTLRTR(31)                            CURVES    10
      COMMON /PLOTDAT/ RPMS,FUELBRN                                CURVES    11
      COMMON /ACCUMS/ TOTLMIS,TOTLFLB,TOTLRPM,TOTLPOP,TOTLBUY,TOTLRTR CURVES  12
      COMMON /STARTER/ NOCRVS,DUMMY                                CURVES    13
C                                                                  CURVES    14
C     INCREMENT NUMBER OF CURVES                                   CURVES    15
C                                                                  CURVES    16
      NOCRVS=NOCRVS+1                                              CURVES    17
C                                                                  CURVES    18
C     FOR EACH YEAR, LOAD ELEMENTS OF ARRAYS WITH RPMS FLOWN AND   CURVES    19
C     FUEL BURNED BY THE ASSOCIATED AIRCRAFT TYPE                  CURVES    20
C                                                                  CURVES    21
      DO 10 YRNO=1,31,1                                            CURVES    22
      RPMS    (NOCRVS,YRNO)=TOTLRPM(YRNO)                          CURVES    23
      FUELBRN (NOCRVS,YRNO)=TOTLFLB(YRNO)                          CURVES    24
   10 CONTINUE                                                     CURVES    25
      RETURN                                                       CURVES    26
      END                                                          CURVES    27
```

```
      SUBROUTINE PLOTTER (LUN)
C
C     THIS SUBROUTINE PLOTS REVENUE PASSENGER MILES AND FUEL
C     CONSUMPTION AIRCRAFT MARKET SHARE CURVES
C
      DIMENSION YEARS(33),CURVE(33)
      DIMENSION RPMS(30,31),FUELBRN(30,31)
      DIMENSION MRKTYPE(6),PLTRPMS(3),PLTFUEL(3)
      INTEGER YRNO
      COMMON /STARTER/ NOCRVS,MRKTYPE,D1,D2,PLTRPMS,PLTFUEL,PERCENT
      COMMON /PLOTDAT/ RPMS,FUELBRN
C
C     PLOTS PERFORMS INITIALIZATION OF THE PLOTTING SOFTWARE
C
      CALL PLOTS(LUN)
      DO 10 YRNO=1,31,1
      YEAR=1974.+YRNO
      YEARS(YRNO)=YEAR
   10 CONTINUE
C
C     READ IN DATA FOR AXIS SCALING
C
      READ (5,2) TOPFBRN,NOMRKSF,TOPRPMS,NOMRKSR
    2 FORMAT(2(E10.4,I10))
      IF (EOF(5)) 15,18
C
C     IF NO DATA WAS READ IN, COMPUTE SCALE
C
   15 CONTINUE
      MAXFBRN=FUELBRN(NOCRVS,31)/1.E08+.5
      TOPFBRN=1.E08*MAXFBRN
      MAXRPMS=RPMS(NOCRVS,31)/1.E11+.5
      TOPRPMS=1.E11*MAXRPMS
      NOMRKSF=4
      NOMRKSR=4
   18 CONTINUE
      XSC=(2005.-1975.)/9.
      XC=1975.
      YSC=TOPFBRN/6.
C
C     LINAXS PLOTS AND LABELS A LINEAR AXIS
C
      CALL LINAXS (1.,1.,9.,7.,.125,-1,30,5,1975.,2005.,4,4,4HYEAR)
      CALL LINAXS (1.,1.,9.,7.,.125,+1,    NOMRKSF,10,0.0,TOPFBRN,3,13,
     X10HFUELBURNED)
C
C     PLOT HEADING
C
      CALL SYMBOL(1.7,7.5,.14,45HFORECAST U.S. AIRLINE FUEL USAGE DISTRI
     XBUTION,0.,45)
      CALL NUMBER(4.,7.25,.12,PERCENT,0.,1)
      CALL SYMBOL(4.3,7.25,.120,17H%/YR= RPM GROWTH,0.,15)
      CALL PLOT (.,1.,-3)
C
C     PLOT MARKET NAME
C
      CALL SYMBOL (9.25,.5*PLTFUEL(1)/YSC+.125,.125,MRKTYPE(1),0.,6)
```

```
      CALL SYMBOL (8.25,.5*PLTFUEL(1)/YSC-.125,.125,MRKTYPE(2),0.,5)    PLOTTER  59
      CALL SYMBOL (8.25,.5*(PLTFUEL(1)+PLTFUEL(2))/YSC+.125,.125,MRKTYPE PLOTTER  60
     X        (3),0.,6)                                                  PLOTTER  61
      CALL SYMBOL (8.25,.5*(PLTFUEL(1)+PLTFUEL(2))/YSC-.125,.125,MRKTYPE PLOTTER  62
     X        (4),0.,5)                                                  PLOTTER  63
      CALL SYMBOL (8.25,.5*(PLTFUEL(2)+PLTFUEL(3))/YSC+.125,.125,MRKTYPE PLOTTER  64
     X        (5),0.,6)                                                  PLOTTER  65
      CALL SYMBOL (8.25,.5*(PLTFUEL(2)+PLTFUEL(3))/YSC-.125,.125,MRKTYPE PLOTTER  66
     X        (6),0.,5)                                                  PLOTTER  67
C                                                                        PLOTTER  68
C     PLOT YEARLY FUEL CONSUMPTION FOR EACH AIRCRAFT TYPE, REFERENCING   PLOTTER  69
C     EACH CURVE TO THE CUMULATIVE FUEL CONSUMED BY AIRCRAFT TYPES       PLOTTER  70
C     ALREADY PLOTTED                                                    PLOTTER  71
C                                                                        PLOTTER  72
      DO 50 NO=1,NOCRVS,1                                                PLOTTER  73
      DO 40 YRNO=1,31,1                                                  PLOTTER  74
      CURVE(YRNO)=FUELBRN(NO,YRNO)                                       PLOTTER  75
   40 CONTINUE                                                           PLOTTER  76
      CALL PLOT((YEARS(1)-X0)/XSC,CURVE(1)/YSC,3)                        PLOTTER  77
      DO 48 I=1,31,1                                                     PLOTTER  78
      CALL PLOT ((YEARS(I)-X0)/XSC, CURVE(I)/YSC,2)                      PLOTTER  79
   48 CONTINUE                                                           PLOTTER  80
   50 CONTINUE                                                           PLOTTER  81
      CALL RSTR(LUN)                                                     PLOTTER  82
      CALL PLOT (0.,-1.,-3)                                              PLOTTER  93
      YSC=TOPRPMS/6.0                                                    PLOTTER  94
C                                                                        PLOTTER  95
C     PLOT AXIS LABELS                                                   PLOTTER  86
C                                                                        PLOTTER  97
      CALL LINAXS (1.,1.,9.,7.,.125,-1,30,5,1975.,2005.,4,4,4HYEAR)      PLOTTER  88
      CALL LINAXS (1.,1.,7.,7.,.125,+1,  NOMRKSR,10,0.0,TOPRPMS,3,3,3HRP PLOTTER  89
     XM)                                                                 PLOTTER  90
C                                                                        PLOTTER  91
C     PLOT HEADING                                                       PLOTTER  92
C                                                                        PLOTTER  93
      CALL SYMBOL(2.2,7.50,.18,40HFORECAST U.S. AIRLINE FLEET DISTRIBUTI PLOTTER  94
     XON,0.,40)                                                          PLOTTER  95
      CALL NUMBER(4.,7.25,.12,PERCENT,0.,3)                              PLOTTER  96
      CALL SYMBOL(4.3,7.25,.12,.17H%/YR RPM GROWTH,0.,15)                PLOTTER  97
      CALL PLOT (1.,1.,-3)                                               PLOTTER  98
C                                                                        PLOTTER  99
C     PLOT MARKET NAME ON SIDE OF GRAPH                                  PLOTTER 100
C                                                                        PLOTTER 101
      CALL SYMBOL (8.25,.5*PLTRPMS(1)/YSC+.125,.125,MRKTYPE(1),0.,6)     PLOTTER 102
      CALL SYMBOL (8.25,.5*PLTRPMS(1)/YSC-.125,.125,MRKTYPE(2),0.,5)     PLOTTER 103
      CALL SYMBOL (8.25,.5*(PLTRPMS(1)+PLTRPMS(2))/YSC+.125,.125,MRKTYPE PLOTTER 104
     X        (3),0.,6)                                                  PLOTTER 105
      CALL SYMBOL (8.25,.5*(PLTRPMS(1)+PLTRPMS(2))/YSC-.125,.125,MRKTYPE PLOTTER 106
     X        (4),0.,5)                                                  PLOTTER 107
      CALL SYMBOL (8.25,.5*(PLTRPMS(2)+PLTRPMS(3))/YSC+.125,.125,MRKTYPE PLOTTER 108
     X        (5),0.,6)                                                  PLOTTER 109
      CALL SYMBOL (8.25,.5*(PLTRPMS(2)+PLTRPMS(3))/YSC-.125,.125,MRKTYPE PLOTTER 110
     X        (6),0.,5)                                                  PLOTTER 111
C                                                                        PLOTTER 112
C     PLOT YEARLY RPMS FLOWN FOR EACH AIRCRAFT TYPE, REFERENCING         PLOTTER 113
C     EACH CURVE TO THE CUMULATIVE FUEL CONSUMED BY AIRCRAFT TYPES       PLOTTER 114
C     ALREADY PLOTTED                                                    PLOTTER 115
```

```
      C
            DO 30 NO=1,NOCRVS,1                                    PLOTTER   116
            DO 20 YRNO=1,31,1                                      PLOTTER   117
            CURVE(YRNO)=RPMS(NO,YRNO)                              PLOTTER   118
         20 CONTINUE                                               PLOTTER   119
            CALL PLOT((YEARS(1)-XL)/XSC,CURVE(1)/YSC,3)            PLOTTER   120
            DO 26 I=1,31,1                                         PLOTTER   121
            CALL PLOT ((YEARS(I)-XL)/XSC, CURVE(I)/YSC,2)          PLOTTER   122
         26 CONTINUE                                               PLOTTER   123
         30 CONTINUE                                               PLOTTER   124
            CALL PSTR(LUN)                                         PLOTTER   125
            RETURN                                                 PLOTTER   126
            END                                                    PLOTTER   127
                                                                   PLOTTER   128
```

```
      SUBROUTINE PLOTSGL (MRKT)
C
C     THIS SUBROUTINE PLOTS REVENUE PASSENGER MILES AND FUEL
C     CONSUMPTION VERSUS TIME FOR EACH AIRCRAFT TYPE
C
      DIMENSION TYPE(10),YRINTRO(10),SEATS(10),SFC(10),SPEED(10),
     XUTILIZ(10),LIFETIM(10),PLOTS(10)
      DIMENSION SEATMI(10,31),FUELBRN(10,31),RPM(10,31),POPUL(10,31)
      DIMENSION MRKTYPE(5),PLTRPMS(3),PLTFUEL(3),NOBUYS(10,46),LF(31)
      DIMENSION YEARS(31),FBURNED(31),RPMS(31),NORETIR(10,46)
      REAL NOBUYS,NORETIR
      INTEGER IN,OUT,YR,YEAR,YRNO
      COMMON /STATIST/ TYPE,YRINTRO,SEATS,SFC,SPEED,UTILIZ,LF,LIFETIM
     *,PLOTS
      COMMON/RESULTS/ SEATMI,FUELBRN,RPM
      COMMON /POP/     NOBUYS,NORE..R,POPUL
      COMMON /INDICES/ NOEXPLS,IN,OUT
      COMMON /STARTER/ NOCRVS,MRKTYPE,D1,D2,PLTRPMS,PLTFUEL,PERCENT
      LUN11=11
      X0=1975.
      XSC=(2005.-1975.)/8.
      DO 10 YRNO=1,31,1
      YEAR=1974.+YRNO
      YEARS(YRNO)=YEAR
   10 CONTINUE
      MAXFBRN=PLTFUEL(MRKT)/1.E09+.5
      TOPFBRN=1.E09*MAXFBRN
      MAXRPMS=PLTRPMS(MRKT)/1.E11+.5
      TOPRPMS=1.E11*MAXRPMS
      NOMRKSF=40
      NOMRKS9=40
      YSC=TOPFBRN/6.0
C
C     PLOT YEARLY FUEL CONSUMPTION FOR EACH AIRCRAFT TYPE
C
      DO 200 I=1,OUT,1
      IF (PLOTS(I).EQ.10H          ) GO TO 200
C
C     PLOT AXIS LABELS
C
      CALL LINAXS(1.,1.,9.,7.,.125,-1,30,5,1975.,2005.,4,4,4HYEAR)
      CALL LINAXS(1.,1.,9.,7.,.125,+1,   NOMRKSF,10,0.0,TOPFBRN,3,10,10H
     XFUELBURNED)
      CALL PLOT(1.,1.,-3)
      DO 100 YEAR=1975,2005,1
      YR=YEAR-1974
      FBURNED(YR)=FUELBRN(I,YR)*POPUL(I,YR)
      RPMS   (YR)=RPM    (I,YR)*POPUL(I,YR)
  100 CONTINUE
      CALL PLOT ((YEARS(1)-X0)/XSC,FBURNED(1)/YSC,3)
      DO 150 J=1,31,1
      CALL PLOT ((YEARS(J)-X0)/XSC,FBURNED(J)/YSC,2)
  150 CONTINUE
      CALL RSTR(LUN11)
      CALL PLOT (0.,-1.,-3)
  200 CONTINUE
      YSC=TOPRPMS/6.0
```

```
C
C     PLOT YEARLY RPMS FLOWN FOR EACH AIRCRAFT TYPE
C
      DO 400 I=1,UNIT,1
      IF (PLOTS(I).EQ.1H               )  GO TO 400
C
C     PLOT AXIS LABELS
C
      CALL LTNAXS(1.,1.,2.,7.,.125,-1,30,5,1975.,2005.,4,4,4HYEAR)
      CALL LTNAXS(1.,1.,9.,7.,.125,+1,  NOMRKSR,13,C.0,TOPRPMS,3,3,34RPM
     Y)
      CALL PLOT(1.,1.,-3)
      CALL PLOT ((YEARS(1)-X0)/XSC,RPMS(1)/YSC,3)
      DO 300 J=1,31,1
      CALL PLOT ((YEARS(J)-X0)/XSC,RPMS(J)/YSC,2)
  300 CONTINUE
      CALL RSTR(LUN11)
      CALL PLOT (0.,-1.,-3)
  400 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SETUP(LUN11)
C                                                          SETUP     2
C     THIS SUBROUTINE INITIALIZES THE PLOTTING SOFTWARE    SETUP     3
C     ON LOGICAL UNIT LUN11                                SETUP     4
C                                                          SETUP     5
      CALL PLOTS (LUN11)                                   SETUP     6
      RETURN                                               SETUP     7
      END                                                  SETUP     8
                                                           SETUP     9
```

Appendix D

LISTING OF PROGRAM SOURCE CODE FOR THE AIRFRAME MANUFACTURER MODULE

```
      SUBROUTINE INPLANT
C
C     THIS SUBROUTINE IS THE DRIVER ROUTINE FOR THE AIRFRAME
C     MANUFACTURERS MODULE
C
      INTEGER YR,IYR,EYR,YEAR
      INTEGER PERIOD,NOEXPLS,IN,OUT
      REAL DEMAND,NOBUYS
      DIMENSION DEMAND(31)
      DIMENSION NOBUYS(10,46),NORETIR(10,46),POPUL(10,31)
      DIMENSION RR(20),PP(20)
      COMMON /PRICEO/ PRICEO
      COMMON /POP/ NOBUYS,NORETIR,POPUL
      COMMON /DEMAND/ DEMAND
      COMMON/LIFETIM/ PERIOD
      COMMON /STARTUP/ IMNTH
      COMMON /INDICES/ NOEXPLS,IN,OUT
      COMMON /PRINT/ IP
C
C     MAIN CYCLE THROUGH NEW AIRCRAFT TYPES
C
      DO 100 I=IN,OUT,1
C
C     FIND FIRST YEAR OF DEMAND
C
      DO 10 YEAR=1975,2005,1
      YR=YEAR-1974
      IF (NOBUYS(I,15+YR).EQ.0.0)  GO TO 10
      IYR=YR
      IMNTH=12*IYR
      GO TO 20
   10 CONTINUE
   20 CONTINUE
C
C     FIND LAST YEAR OF DEMAND
C
      DO 30 YEAR=1975,2005,1
      YR=2006-YEAR
      IF (NOBUYS(I,15+YR).EQ.0.0)  GO TO 30
      EYR=YR
      GO TO 40
   30 CONTINUE
   40 CONTINUE
C
C     SET AND WRITE DEMAND HISTORY
C
      DO 50 J=1,30,1
      DEMAND(J)=0.0
   50 CONTINUE
      DO 60 YR=IYR,EYR,1
      DEMAND(YR-IYR+1)=NOBUYS(I,15+YR)
   60 CONTINUE
      WRITE (6,5) (DEMAND(J),J=1,30,1)
    5 FORMAT(5E21.14)
      PERIOD=EYR-IYR+1
      WRITE (6,6) PERIOD
    6 FORMAT(* PERIOD = *,I3)
```

ORIGINAL PAGE IS OF POOR QUALITY

```
C                                                                INPLANT    59
C     CALL SUBROUTINES TO DEVELOP PRODUCTION SCHEDULE,           INPLANT    60
C     MANUFACTURING COSTS AND MARKET PRICES                      INPLANT    61
C                                                                INPLANT    62
      CALL PLANT                                                 INPLANT    63
      CALL ACCOST                                                INPLANT    64
      CALL ACPRICE                                               INPLANT    65
      READ (5,1) PO,DELTAP                                       INPLANT    66
    1 FORMAT(2F3.0)                                              INPLANT    67
      PRICEO=PO-DELTAP                                           INPLANT    68
      IP=1                                                       INPLANT    69
C                                                                INPLANT    70
C     INNER LOOP TO CYCLE THROUGH SUBROUTINES DETERMINING CASHFLOW  INPLANT 71
C     AND INTERNAL RATE OF RETURN FOR BASE PRICE PLUS 13 INCREMENTS INPLANT 72
C                                                                INPLANT    73
      DO 100 J=1,14,1                                            INPLANT    74
      IF (J.EQ.14)  IP=0                                         INPLANT    75
      PRICEJ=PRICEJ+DELTAP                                       INPLANT    76
      CALL CASHFLW                                               INPLANT    77
      CALL INTROR(R)                                             INPLANT    78
      PP(J)=PRICE,                                               INPLANT    79
      PR(J)=R                                                    INPLANT    80
      WRITE (6,2) PR(J),PP(J)                                    INPLANT    81
    2 FORMAT(* ROIN = *,F10.5,* PMAX = *,F10.6)                  INPLANT    82
  100 CONTINUE                                                   INPLANT    83
      RETURN                                                     INPLANT    84
      END                                                        INPLANT    85
```

```
      SUBROUTINE RDTE                                                   RDTE       2
C                                                                       RDTE       3
C     THIS SUBROUTINE DISTRIBUTES RDTE COSTS OVER LIFE OF               RDTE       4
C     PRODUCTION PROGRAM TO ESTIMATE COSTS ON A PER MONTH BASIS         RDTE       5
C                                                                       RDTE       6
      DIMENSION TRDTEC (5),RDTELBL(5),DELAY(5),PERIOD(5),RDTECMP(5,372) RDTE       7
      INTEGER DELAY,PERIOD                                              RDTE       8
      INTEGER IN,OUT,TTS                                                RDTE       9
      COMMON /TRDTEC / TRDTEC                                           RDTE      10
      COMMON /RDTECMP/ RDTECMP                                          RDTE      11
      COMMON /RDTELBL/ RDTELBL                                          RDTE      12
      COMMON /TTS/      TTS                                             RDTE      13
      COMMON /DELAY/ DELAY                                              RDTE      14
      COMMON /PERIOD/ PERIOD                                            RDTE      15
      DATA (DELAY(I),I=1,5,1)/0,3,3,6,12/                               RDTE      16
      DATA (PERIOD(I),I=1,5,1)/42,42,42,52,42/                          RDTE      17
      RDTELBL(1)=7LAIRFMOE                                              RDTE      18
      RDTELBL(2)=7LSUBSYSD                                              RDTE      19
      RDTELBL(3)=7LAVONICS                                              RDTE      20
      RDTELBL(4)=7LPROPULS                                              RDTE      21
      RDTELBL(5)=7LDEVELOP                                              RDTE      22
C                                                                       RDTE      23
C     DISTRIBUTE THE FIVE RDTE COSTS                                    RDTE      24
C                                                                       RDTE      25
      DO 200 ITH=1,5,1                                                  RDTE      26
      LN=PERIOD(ITH)                                                    RDTE      27
      IN=TTS-LN+1+DELAY(ITH)                                            RDTE      28
      OUT=TTS+DELAY(ITH)                                                RDTE      29
      DO 100 MNTH=IN,OUT,1                                              RDTE      30
      RDTECMP(ITH,MNTH)=TRDTEC (ITH)/PERIOD(ITH)                        RDTE      31
  100 CONTINUE                                                          RDTE      32
  200 CONTINUE                                                          RDTE      33
      RETURN                                                            RDTE      34
      END                                                               RDTE      35
```

```
      SUBROUTINE COMPCOS                                              COMPCOS   2
C                                                                     COMPCOS   3
C     THIS SUBROUTINE DISTRIBUTES COMPONENT MANUFACTURING COSTS       COMPCOS   4
C     OVER LIFE OF PRODUCTION PROGRAM TO ESTIMATE COST ON A PER       COMPCOS   5
C     MONTH BASIS                                                     COMPCOS   6
C                                                                     COMPCOS   7
      INTEGER PROSCHL,PRODUCT                                         COMPCOS   8
      INTEGER PROD1,PROD2,END1,TTS                                    COMPCOS   9
      DIMENSION ORDER(4000),PRODUCT(4000),DELIVER(4000)               COMPCOS  10
      DIMENSION PROSCHL(396)                                          COMPCOS  11
      DIMENSION PRODIOS(11),COMPCST(11,372),TTLCMP (11)               COMPCOS  12
      REAL LEARN,LEARNA,LEARNP                                        COMPCOS  13
      COMMON /CSHFLO/ CAVION,AMFG,PROPU,XFASSY,ENSPAD,LEARN,LEARNA,   COMPCOS  14
     X        LEARNP                                                  COMPCOS  15
      COMMON / COSTOT / AC, ADDE, AGEQ, AGEP, AQ, AOFEE, C(37,5),     COMPCOS  16
     X                  CD, CF, DDEL, DS, FAC, FTS, FTO, FV, GTS, GTV,   COMPCOS  17
     X                  IT, MEQ, NDATA, NFV, NG, NV, NVEH(5), OS, OT,    COMPCOS  18
     X                  OV, POTJ, RDFEE, SE, ST, SUBSYS, TDO, TOP, NVHF, COMPCOS  19
     X                  TRDTE, TRI, TST                               COMPCOS  20
      COMMON /PRODUCT/ PRODUCT                                        COMPCOS  21
      COMMON /PROSCHL/ PROSCHL                                        COMPCOS  22
      COMMON /TTS/ TTS                                                COMPCOS  23
      COMMON /ORDER/  ORDER                                           COMPCOS  24
      COMMON /DELIVER/ DELIVER                                        COMPCOS  25
      COMMON /TTLCMP / TTLCMP                                         COMPCOS  26
      COMMON /COMPCST/ COMPCST                                        COMPCOS  27
      COMMON /PRODIOS/ PRODIOS                                        COMPCOS  28
      COMMON /TOTAL/ TTOTAL                                           COMPCOS  29
C                                                                     COMPCOS  30
C     PARAMETER INITIALIZATION                                        COMPCOS  31
C                                                                     COMPCOS  32
      NOCOMP=11                                                       COMPCOS  33
      PRODIOS(1)=5HMANUF                                              COMPCOS  34
      PRODIOS(2)=6HSPARES                                             COMPCOS  35
      PRODIOS(3)=8LFACILITI                                           COMPCOS  36
      PRODIOS(4)=7LSUSENGP                                            COMPCOS  37
      PRODIOS(5)=7LSUSTOOL                                            COMPCOS  38
      PRODIOS(6)=7LGSEQUIP                                            COMPCOS  39
      PRODIOS(7)=8LTECHDATA                                           COMPCOS  40
      PRODIOS(8)=8LMISCEQUP                                           COMPCOS  41
      PRODIOS(9)=9LTRAINEQUP                                          COMPCOS  42
      PRODIOS(10)=8LITILTRNG                                          COMPCOS  43
      PRODIOS(11)=9LITILTRANS                                         COMPCOS  44
      WRITE (6,1) (TTLCMP(I),I=1,11,1)                                COMPCOS  45
    1 FORMAT(1X,11E11.4)                                              COMPCOS  46
      DO 50 I=1,11,1                                                  COMPCOS  47
      DO 50 J=1,372,1                                                 COMPCOS  48
      COMPCST(I,J)=0.0                                                COMPCOS  49
   50 CONTINUE                                                        COMPCOS  50
      ZAV=1.+ALOG(LEARNA/100.)/ALOG(2.)                               COMPCOS  51
      ZP =1.+ALOG(LEARNP/100.)/ALOG(2.)                               COMPCOS  52
      ZAF=1.+ALOG(LEARN/100. )/ALOG(2.)                               COMPCOS  53
      CAVON=1.                                                        COMPCOS  54
      CAFOC=0.                                                        COMPCOS  55
      CPDO=0.                                                         COMPCOS  56
      OSPO=0.                                                         COMPCOS  57
      SEO=0.                                                          COMPCOS  58
```

```
      STO=0.
C
C     LOOP THROUGH EACH AIRCRAFT TO BE PRODUCED.
C     CALCULATE COSTS BASED ON LEARNING CURVES.
C
      DO 100 ITHPL=1,ITOTAL,1
      CAVO1=FLOAT(ITHPL)**ZAV
      CAFO1=FLOAT(ITHPL)**ZAF
      CPO1=FLOAT(ITHPL)**ZP
      CAVO=CAVION*(CAVO1-CAVOO)
      CAFO=AMFG*(CAFO1-CAFOO)
      CPO=PRODPU*(CPO1-CPOO)
      CAVOO=CAVO1
      CAFOO=CAFO1
      CPOO=CPO1
      OV=(CAVO+CAFO+CPO)*(1.+XFASSY)
      UMC=OV
      OSA=.13*(CAFO+CAVO)
      OSP1=(FLOAT(ITHPL)*(1.+ENSPAO))**ZP-FLOAT(ITHPL)**ZP
      OSP=PRODPU*(OSP1-OSPO)
      OSPO=OSP1
      OS=OSA+OSP
      SPARES=OS
      SE1=FLOAT(ITHPL)**.20-1.
      SE=ADOE*(SE1-SEO)
      SEO=SE1
      ST1=FLOAT(ITHPL)**.14-1.
      ST=TST*(ST1-STO)
      STO=ST1
C
C     SPREAD PRODUCTION COSTS UNIFORMLY OVER SCHEDULED MONTH AND
C     ELEVEN PRECEEDING MONTHS
C
      DO 80 MNTH=1,12,1
      J=12-MNTH
      COMPCST(1,PRODUCT(ITHPL)-J)=COMPCST(1,PRODUCT(ITHPL)-J)+UMC/12.
      COMPCST(2,PRODUCT(ITHPL)-J)=COMPCST(2,PRODUCT(ITHPL)-J)+SPARES/12.
      COMPCST(3,PRODUCT(ITHPL)-J)=COMPCST(3,PRODUCT(ITHPL)-J)
     X                            +TTLCMP (3)/(12.*ITOTAL)
      COMPCST(4,PRODUCT(ITHPL)-J)=COMPCST(4,PRODUCT(ITHPL)-J)+SE/12.
      COMPCST(5,PRODUCT(ITHPL)-J)=COMPCST(5,PRODUCT(ITHPL)-J)+ST/12.
      DO 60 ITH=5,NOCOMP,1
      COMPCST(ITH,PRODUCT(ITHPL)-J)=COMPCST(ITH,PRODUCT(ITHPL)-J)
     X                              +TTLCMP (ITH)/(12.*ITOTAL)
   60 CONTINUE
   80 CONTINUE
  100 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE REVENUE
C
C     THIS SUBROUTINE COMPUTES INCOME ON A PER MONTH BASIS.  ASSUMED
C     PAYMENT SCHEDULE IS THAT AIRLINES WILL PAY 5% ON ORDER, 70% ON
C     DELIVERY AND 25% SPREAD OVER MONTHS BETWEEN ORDER AND DELIVERY
C
      DIMENSION ORDER(4000),DELIVER(4000)
      DIMENSION INCOME(372),ACCINCO(372)
      INTEGER TOTAL,ORITHPL,DEITHPL
      INTEGER ORDER,DELIVER
      REAL INCOME
      COMMON /INCOME/ INCOME
      COMMON /ACCINCO/ ACCINCO
      COMMON /ORDER/ ORDER
      COMMON /DELIVER/ DELIVER
      COMMON /PRICEO/ PRICEO
      COMMON /TOTAL/ TOTAL
C
C     INITIALIZE ARRAYS TO ZERO
C
      DO 100 I=1,372,1
      INCOME(I)=0.0
      ACCINCO(I)=0.0
100   CONTINUE
C
C     FOR EACH AIRCRAFT TO BE PRODUCED, ADD REVENUES FROM DOWN
C     PAYMENT, PAYMENTS BETWEEN ORDER AND DELIVERY, AND FINAL
C     PAYMENT ON DELIVERY.
C
      DO 300 ITHPL=1,TOTAL,1
      INCOME(ORDER(ITHPL))=INCOME(ORDER(ITHPL))+.05*PRICEO
      INCOME(DELIVER(ITHPL))=INCOME(DELIVER(ITHPL))+.70*PRICEO
      ORITHPL=ORDER(ITHPL)+1
      DEITHPL=DELIVER(ITHPL)-1
      DO 200 MNTHPAY=ORITHPL,DEITHPL,1
      INCOME(MNTHPAY)=INCOME(MNTHPAY)+.25/(DEITHPL-ORITHPL+1)*PRICEO
200   CONTINUE
300   CONTINUE
      SUM=0.0
C
C     CALCULATE THE CUMULATIVE REVENUES FOR EACH MONTH
C
      DO 400 MNTH=1,372,1
      SUM=SUM+INCOME(MNTH)
      ACCINCO(MNTH)=SUM
400   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CASHFLW
C
C     THIS SUBROUTINE DETERMINES INDIVIDUAL MONTHLY CASHFLOW AND
C     CUMULATIVE MONTHLY CASHFLOW FOR ESTIMATED COSTS AND
C     REVENUES
C
      DIMENSION CASHFLO(372),ACCASHF(372)
      DIMENSION COST(372),ACCOST(372)
      DIMENSION ACCINCO(372)
      DIMENSION RDTECMP(5,372),COMPCST(11,372),INCOME(372)
      REAL INCOME
      COMMON /RDTECMP/ RDTECMP
      COMMON /COMPCST/ COMPCST
      COMMON /INCOME/ INCOME
      COMMON /ACCINCO/ ACCINCO
      COMMON /COST/ COST
      COMMON /ACCOST/ ACCOST
      COMMON /CASHFLO/ CASHFLO
      COMMON /ACCASHF/ ACCASHF
C
C     CALL SUBROUTINES TO SPREAD INDIVIDUAL RDTE, PRODUCTION COMPONENT
C     COSTS AND REVENUES BY MONTH
C
      CALL RDTE
      CALL REVENUE
      CALL COMPCOS
C
C     SUM RDTE AND PRODUCTION COST FACTORS PER MONTH AND
C     CUMULATIVE BY MONTH
C
      SUM=0.
      DO 30 MNTH=1,372,1
      SUM1=0.0
      DO 10 ITH=1,5,1
      SUM1=SUM1+RDTECMP(ITH,MNTH)
   10 CONTINUE
      SUM2=0.0
      DO 20 ITH=1,11,1
      SUM2=SUM2+COMPCST(ITH,MNTH)
   20 CONTINUE
      COST(MNTH)=SUM1+SUM2
      SUM=SUM+SUM1+SUM2
      ACCOST(MNTH)=SUM
   30 CONTINUE
C
C     CALCULATE CASHFLOW EACH MONTH AND CUMULATIVE BY MONTH
C
      DO 40 MNTH=1,372,1
      CASHFLO(MNTH)=INCOME(MNTH)-COST(MNTH)
      ACCASHF(MNTH)=ACCINCO(MNTH)-ACCOST(MNTH)
   40 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE INRR(R)
C
C     THIS SUBROUTINE CALCULATES INTERNAL RATE OF RETURN FOR
C     ESTIMATED CASHFLOW
C
      DIMENSION CASHFLO(372),RIMCI(31),PV(31),OCF(31)
      DIMENSION ACCASHF(372)
      REAL K,KK,KKK
      COMMON /CASHFLO/ CASHFLO
      COMMON /ACCASHF/ ACCASHF
C
C     PARAMETER INITIALIZATION
C
      KK=0.
      KKK=0.
      RR=0.
      RRP=0.
      NL=31
      ICNT=0
      IF (ACCASHF(372).LT.0.0)  GO TO 10
      R=1.E-32
      DELTAR=.001
      GO TO 20
   10 CONTINUE
      R=-1.E-32
      DELTAR=.001
C
C     MAIN PROGRAM LOOP POINT.  CYCLE UNTIL ITERATION STOP CRITERIA
C     ARE MET.  CALCULATE DISCOUNTED PRESENT VALUE SUM OF CASHFLOW
C     USING ESTIMATED RATE OF RETURN VALUE.
C
   20 CONTINUE
      DO 30 I=1,31,1
      RIMCI(I)=0.0
      PV(I)=(1.+R)**(-I)
   30 CONTINUE
      DO 40 I=1,372,1
      J=(I-1)/12+1
      RIMCI(J)=RIMCI(J)+CASHFLO(I)
   40 CONTINUE
      IS=1
      DO 42 I=1,31,1
      IF (RIMCI(I).EQ.0.0)  GO TO 42
      IS=I
      GO TO 44
   42 CONTINUE
   44 CONTINUE
      IL=31
      DO 46 I=1,31,1
      J=32-I
      IF (RIMCI(J).EQ.0.0)  GO TO 46
      IL=J
      GO TO 48
   46 CONTINUE
   48 CONTINUE
      DO 49 I=IS,IL,1
      RIMCI(I-IS+1)=RIMCI(I)
```

```
      RINCI(I)=0.
   49 CONTINUE
      NL=IL-IS+1
      SUM=RINCI(1)
      DCF(1)=SUM
      DO 50 I=2,NL,1
      DCF(I)=RINCI(I)*PV(I-1)
      SUM=SUM+DCF(I)
   50 CONTINUE
C
C     BEGIN TESTING OF VALUES TO DETERMINE IF ITERATION STOP
C     CRITERIA ARE MET.  UPDATE VALUES AND CONTINUE IF CRITERIA
C     NOT MET.
C
      K=ABS(SUM)-0.009
      IF  (KKK.EQ.K)  GO TO 90
      KKK=KK
      RRR=RR
      KK=K
      RR=R
      ICNT=ICNT+1
      IF (MOD(ICNT,10).NE.0)  GO TO 55
      WRITE (6,101) R,K
   55 CONTINUE
      IF (K.LE.1E-32)  GO TO 120
      IF (SUM) 60,120,70
    * ASSUME DELTA R
   60 CONTINUE
      R=R-DELTAR
      GO TO 80
   70 CONTINUE
      R=R+DELTAR
   80 CONTINUE
      GO TO 20
C
C     ITERATION STOP CRITERIA HAVE BEEN MET.  FIND PROPER VALUE
C     FOR INTERNAL RATE OF RETURN AND PRINT RESULTS.
C
   90 CONTINUE
      IF (KKK-KK) 100,110,120
  100 R=RRR
      GO TO 120
  110 R=RR
  120 CONTINUE
      WRITE (6,101) R,K
  101 FORMAT(2F20.7)
      RETURN
      END
```

```
      SUBROUTINE PLANT
C
C     THIS SUBROUTINE DETERMINES OPTIMAL PRODUCTION, DELIVERY, AND
C     ORDER SCHEDULES FOR EACH NEW AIRFRAME TYPE BASED ON DEMAND
C     SCHEDULE
C
      INTEGER LTIME,FIRSTPR,LIFETIM,PROD1,FP1
      INTEGER PROD2,TS,TTS,END1,END2
      INTEGER DELSCHL
      INTEGER ORDER,DELIVER,PRODUCT,PROSCHL
      INTEGER IACCUM
      INTEGER MAXP,MAXAC
      INTEGER BRRKPT,BRKPT,KICKOFF,DISCREP
      REAL ACCUM,SUMDIF,AVGDIF
      DIMENSION KICKOFF(29),DISCREP(29)
      DIMENSION DEMAND(31),PRODUCT(4000),PROSCHL(396),DELIVER(4000)
      DIMENSION DELSCHL(396),LTIME(372),ORDER(4000)
      COMMON /TTS/ TTS
      COMMON /PROSCHL/ PROSCHL
      COMMON /PRODUCT/ PRODUCT
      COMMON /ORDER/ ORDER
      COMMON /DELIVER/ DELIVER
      COMMON /TOTAL/ ITOTAL
      COMMON /MAXP/ MAXP
      COMMON /LIFETIM/ LIFETIM
      COMMON /STARTUP/ TS
      COMMON /DEMAND/ DEMAND
C
C     INITIALIZATION OF BASIC PARAMETERS
C
      DATA (LTIME(I),I=1,372)/372*24/
      MAXAC=4000
      IB=2
      LB=LIFETIM
      NTRY=-1
      DO 8 I=1,29,1
      KICKOFF(I)=0
      DISCREP(I)=0
    8 CONTINUE
C
C     MAIN PROGRAM LOOP.  DIVIDES TOTAL DEMAND PERIOD INTO ALL
C     2-PART COMBINATIONS TO FIND OPTIMAL PRODUCTION RATES
C
  100 CONTINUE
      DO 200 BRKPT=IB,LB,1
      FIRSTPR=BRKPT-1
      TOTAL1=0.
      DO 10 I=1,FIRSTPR
      TOTAL1=TOTAL1+DEMAND(I)
   10 CONTINUE
      ITOTAL1=TOTAL1+.67
      WRITE (6,3) ITOTAL1
    3 FORMAT(* TOTAL DEMAND FOR FIRST PERIOD = *,I10)
      FPROD1=TOTAL1/(12.*FIRSTPR)
      PROD1=FPROD1+.67
      FP1=FIRSTPR+1
      TOTAL2=0.
```

```
      DO 2  I=FP1,LIFETIM
      TOTAL2=TOTAL2+DEMAND(I)
    2 CONTINUE
      ITOTAL2=TOTAL2+.67
      FPROD2=TOTAL2/(12.*(LIFETIM-FIRSTPR))
      PROD2=FPROD2+.67
      WRITE (6,4) ITOTAL2
    4 FORMAT(* TOTAL DEMAND FOR SECOND PERIOD = *,I10)
      MAXP=MAX0(PROD1,PROD2)
      TOTAL=TOTAL1+TOTAL2
      ITOTAL=TOTAL+.67
      WRITE (6,5) ITOTAL
    5 FORMAT(* TOTAL DEMAND FOR THIS AIRCRAFT = *,I10)
      IF(ITOTAL.LE.MAXAC) GO TO 21
      WRITE(6,22) MAXAC
   22 FORMAT(1H0,*TOTAL DEMAND EXCEEDS ARRAY MAXIMUM OF *,I5)
      STOP
   21 TOTAL1=12*PROD1*FIRSTPR
      TOTAL2=ITOTAL-ITOTAL1
      WRITE (6,6) PROD1,PROD2
    6 FORMAT(* PRODUCTION RATE FOR 1ST + 2ND PERIOD RESPECTIVELY IS = *,
     *I5,*,*,I5)
C
C     SKIP NEXT CODE BLOCK AFTER OPTIMAL PRODUCTION
C     SCHEDULE FOUND,
C
      IF (NTRY.EQ.2)  GO TO 25
      TMAX1=0
      TMIN1=0
C*    MINMAX=0
C*    MIN=240
      TTS=TS
C
C     CALCULATE PRODUCTION AND DELIVERY SCHEDULES BASED ON
C     TENTATIVE PRODUCTION PERIOD SUBDIVISION
C
   25 CONTINUE
      DO 24 I=1,4000,1
      PRODUCT(I)=0
   24 CONTINUE
      DO 26 I=1,372,1
      PROSCHL(I)=0
   26 CONTINUE
      DO 30 ITHPL=1,ITOTAL1,1
      JMNTHPL=(ITHPL-1)/PROD1+1
      IF((JMNTHPL+TTS).GT.396) GO TO 30
      PRODUCT(ITHPL)=JMNTHPL+TTS
      PROSCHL(JMNTHPL+TTS)=ITHPL
   30 CONTINUE
      END1=JMNTHPL+TTS
      DO 40 ITHPL=1,ITOTAL2,1
      JMNTHPL=(ITHPL-1)/PROD2+1
      IF((JMNTHPL+END1).GT.396) GO TO 40
      PRODUCT(ITOTAL1+ITHPL)=JMNTHPL+END1
      PROSCHL(JMNTHPL+END1)=ITOTAL1+ITHPL
   40 CONTINUE
      END2=JMNTHPL+END1
```

```
      DO 50 ITHPL=1,ITOTAL
      DELIVER(ITHPL)=PRODUCT(ITHPL)
   50 CONTINUE
      DO 60 JMNTHPL=1,END2
      IF(JMNTHPL.GT.396) GO TO 60
      DELSCHL(JMNTHPL)=PRDSCHL(JMNTHPL)
   60 CONTINUE
C
C     SKIP TO WRAP-UP CODE AFTER OPTIMAL SCHEDULE CALCULATED
C
      IF (NTRY.EQ.2)  GO TO 500
C*    IF(NTRY.EQ.0) GO TO 129       NOT USED
C
C     CALCULATE DIFFERENCES BETWEEN CUMULATIVE PRODUCTION AND DEMAND
C     SCHEDULES AT END OF EACH YEAR OF DEMAND
C
      ACCUM=0.0
      IACCUM=0
      SUMDIF=0.0
      DO 90 IYEAR=1,FIRSTPP,1
      ACCUM=ACCUM+DEMAND(IYEAR)
      IACCUM=ACCUM+0.67
      IDIFF=12*IYEAR+TS-DELIVER(IACCUM)
      SUMDIF=SUMDIF+IDIFF
      IF(IDIFF.GT.IMAX1) GO TO 70
      IF (IDIFF.LT.IMIN1) GO TO 80
      GO TO 90
   70 CONTINUE
      IMAX1=IDIFF
      GO TO 90
   80 CONTINUE
      IMIN1=IDIFF
   90 CONTINUE
C*    NTRY=1       NOT USED
      IMAX2=0
      IMIN2=0
      DO 120 IYEAR=FP1,LIFETIM,1
      ACCUM=ACCUM+DEMAND(IYEAR)
      IACCUM=ACCUM+0.67
      IDIFF=12*IYEAR+TS-DELIVER(IACCUM)
      SUMDIF=SUMDIF+IDIFF
      IF(IDIFF.GT.IMAX2) GO TO 105
      IF(IDIFF.LT.IMIN2) GO TO 110
      GO TO 120
  105 CONTINUE
      IMAX2=IDIFF
      GO TO 120
  110 CONTINUE
      IMIN2=IDIFF
  120 CONTINUE
C
C     COMPUTE STARTING MONTH OFFSET TO IMPROVE PRODUCTION
C     SCHEDULE.
C
      AVGDIF=SUMDIF/LIFETIM+.5
      IF(SUMDIF.LT.0.0) AVGDIF=SUMDIF/LIFETIM-0.5
      IF(AVGDIF.GT.6.0) AVGDIF=6.0
```

```
      IF(AVGDIF.LT.-6.0) AVGDIF=-6.0
      TTS=TTS+AVGDIF
C
C     COMPUTE MINIMAX VALUE FOR THIS PRODUCTION PERIOD SUBDIVISION
C
      MINMAX=MAX0(MAX0(IABS(IMAX1),IABS(IMIN1)),MAX0(IABS(IMAX2),IABS(
     XIMIN2)))
C*    IMAX1=0
C*    IMIN1=0
C*    IMAX2=0
C*    IMIN2=0
C*    NTRY=0
C*    GO TO 25
C*129 CONTINUE
      KICKOFF(BRKPT-1)=TTS
      DISCREP(BRKPT-1)=MINMAX
C*    NTRY=-1
C
C     END OF MAIN PROGRAM LOOP
C
200   CONTINUE
C*300 CONTINUE
C
C     EXAMINE MINIMAX VALUES TO FIND OPTIMUM PRODUCTION
C     SCHEDULE SUBDIVISION AND OFFSET (SMALLEST MAXIMUM DISCREPANCY)
C
      MINMAX=372
      DO 400 BRKPT=IB,LB,1
      IF (DISCREP(BRKPT-1).GE.MINMAX)  GO TO 400
      MINMAX=DISCREP(BRKPT-1)
      BBRKPT=BRKPT
      TTS=KICKOFF(BRKPT-1)
400   CONTINUE
      IB=BBRKPT
      LB=BBRKPT
      NTRY=2
C
C     RECYCLE MAIN LOOP ONCE TO CALCULATE OPTIMUM PRODUCTION
C     SCHEDULE WITH OFFSET
C
      GO TO 100
C
C     CLEANUP CODE AFTER OPTIMUM PRODUCTION SCHEDULE FOUND.  PRINT
C     STARTUP TIME AND COMPUTE ORDER SCHEDULE (24 MONTHS BEFORE
C     DELIVERY)
C
500   CONTINUE
      WRITE (6,121) TTS
121   FORMAT(* TIME FOR START-UP OF PRODUCTION = *,I3)
      DO 600 ITHPL=1,ITOTAL,1
      ORDER(ITHPL)=DELIVER(ITHPL)-LTIME(DELIVER(ITHPL)-TTS)
600   CONTINUE
1     FORMAT(I5)
      IF(TTS.LE.372) GO TO 601
      WRITE(6,603) TTS
  603 FORMAT(1HO,*MONTH FOR STARTUP OF PR     TION (*,I5,*) IS BEYOND END
     1 OF 31 YEAR PERIOD*)
```

```
                  STOP                                                              PLANT   230
230           601 IF(PROSCHL(372).EQ.0) GO TO 602                                   PLANT   231
                  WRITE(6,604) ITOTAL,PROSCHL(372)                                  PLANT   232
              604 FORMAT(1H0,*TOTAL DEMAND CALCULATED (*,I5,*) CANNOT BE PRODUCED IN PLANT   233
                 1 31 YEAR PERIOD*, /,* TOTAL PRODUCED IN THIS PERIOD IS *,I5,/     PLANT   234
                 2* THIS NEW TOTAL WILL BE USED IN PRODUCTION COSTS FOR PERIOD*)    PLANT   235
235               ITOTAL=PROSCHL(372)                                               PLANT   236
              602 RETURN                                                            PLANT   237
                  END                                                               PLANT   238
```

```
      SUBROUTINE INTROR(R)
C
C     THIS SUBROUTINE PRODUCES MONTHLY ACCUMULATED COSTS, CALLS RATE OF
C     RETURN CALCULATION AND PRINTS INCOME, COST, AND CASHFLOW
C     TABLES WHEN PRINT FLAG SET.
C
      DIMENSION ROTECMP(5,372),COMPCST(11,372)
      DIMENSION ACROTE(5,372),ACCMP(11,372)
      DIMENSION ROTELBL(31),PRODIDS(11)
      DIMENSION INCOME(372),ACCINCO(372),CASHFLO(372),ACCASHF(372)
      REAL INCOME
      INTEGER YR,YEAR
      COMMON /ROTECMP/ ROTECMP
      COMMON /COMPCST/ COMPCST
      COMMON /INCOME/ INCOME
      COMMON /ACCINCO/ ACCINCO
      COMMON /CASHFLO/ CASHFLO
      COMMON /ACCASHF/ ACCASHF
      COMMON /ROTELBL/ ROTELBL
      COMMON /PRODIDS/ PRODIDS
      COMMON /PRINT/ IP
C
C     CALCULATE ACCUMULATED MONTHLY SUMS FOR ROTE AND PRODUCTION COSTS
C
      DO 200 ITH=1,5,1
      SUM=0.0
      DO 100 MNTH=1,372,1
      SUM=SUM+ROTECMP(ITH,MNTH)
      ACROTE(ITH,MNTH)=SUM
  100 CONTINUE
  200 CONTINUE
      DO 400 ITH=1,11,1
      SUM=0.0
      DO 300 MNTH=1,372,1
      SUM=SUM+COMPCST(ITH,MNTH)
      ACCMP(ITH,MNTH)=SUM
  300 CONTINUE
  400 CONTINUE
C
C     CALL SUBROUTINE TO COMPUTE INTERNAL RATE OF RETURN FOR
C     ESTIMATED CASHFLOW
C
      CALL INRR(R)
      WRITE (6,5) R
    5 FORMAT(* R = *,E10.3)
      IF (IP.EQ.1) GO TO 700
C
C     WHEN REQUESTED, PRINT TABLES OF INDIVIDUAL MONTHLY INCOME
C     COST AND CASHFLOW FIGURES FOR EACH YEAR FROM 1975-2005
C
      DO 500 YR=1,31,1
      IR=12*(YR-1)
      YEAR=1974+YR
      WRITE (6,4)
    4 FORMAT(*0*)
    6 FORMAT(* *)
      WRITE (6,1)
```

```
      4 FORMAT(T16,*JAN*,T26,*FEB*,T35,*MAR*,T46,*APR*,T56,*MAY*,T65,*JUN*
     X,T76,*JUL*,T86,*AUG*,T96,*SEP*,T106,*OCT*,T116,*NOV*,T126,*DEC*)
        WRITE (6,4)
        DO 94 ITH=1,5,1
        WRITE (6,3) RDTELBL(ITH),YEAR,(RDTECMP(ITH,IR+J),J=1,12,1)
     94 CONTINUE
        WRITE (6,2) YEAR,(INCOME(IR+J),J=1,12,1)
        DO 98 ITH=1,11,1
        WRITE (6,3) PRODIDS(ITH),YEAR,(COMPCST(ITH,IR+J),J=1,12,1)
     98 CONTINUE
        WRITE (6,9) YEAR,(CASHFLO(IR+J),J=1,12,1)
    500 CONTINUE
      C
      C PRINT TABLES OF CUMULATIVE MONTLY INCOME, COST AND CASHFLOW
      C FIGURES FOR EACH YEAR FROM 1975-2005
      C
        DO 600 YR=1,31,1
        IR=12*(YR-1)
        YEAR=1974+YR
        WRITE (6,4)
        WRITE (6,1)
        WRITE (6,6)
        DO 180 ITH=1,5,1
        WRITE (6,3) RDTELBL(ITH),YEAR,(ACRDTE(ITH,IR+J),J=1,12,1)
    180 CONTINUE
        WRITE (6,2) YEAR,(ACCINCO(IR+J),J=1,12,1)
        DO 190 ITH=1,11,1
        WRITE (6,3) PRODIDS(ITH),YEAR,(ACCMP(ITH,IR+J),J=1,12,1)
    190 CONTINUE
        WRITE (6,9) YEAR,(ACCASHF(IR+J),J=1,12,1)
      3 FORMAT(* *,A7,I4,12(1PE10.3))
      2 FORMAT(* INCOME *,I4,12(1PE10.3))
      9 FORMAT(* CASHFLO*,I4,12(1PE10.3))
    600 CONTINUE
    700 CONTINUE
        RETURN
        END
```

```
      SUBROUTINE ACPRICE                                                ACPRICE     2
C                                                                       ACPRICE     3
C     THIS SUBROUTINE ESTIMATES MARKET PLACE PRICES                     ACPRICE     4
C                                                                       ACPRICE     5
C     API      = AVERAGE NATIONAL PRICE/COST INDEX OVER PERIOD OF INTERE ACPRICE    6
C                FRACTIONAL FORM (DEFAULT VALUE =0.06)                  ACPRICE     7
C     FAIRFP   = ESTIMATED AIRFRAME PRICE                               ACPRICE     8
C     EAIRPR   = ESTIMATED AIRPLANE PRICE                               ACPRICE     9
C     EDEVC    = ESTIMATED AIRPLANE DEVELOPMENT COST, MILLIONS          ACPRICE    10
C     EENGPR   = ESTIMATED ENGINES TOTAL PRICE                          ACPRICE    11
C     EN       = NUMBER OF MAIN ENGINES                                 ACPRICE    12
C     EPRICE   = ESTIMATED AIRPLANE MARKET PLACE PRICE                  ACPRICE    13
C     ESEPRT   = ESTIMATED AIRPLANE PRICE BY SEAT COST, MILLIONS        ACPRICE    14
C     EUPROC   = ESTIMATED AIRPLANE UNIT PRODUCTION COST, MILLIONS      ACPRICE    15
C     HP       = ENGINE DESIGN SHAFT HORSEPOWER                         ACPRICE    16
C     IATRPL   = INDICATOR FOR AIRPLANE TYPE                            ACPRICE    17
C                IAIRPL = 1 FOR CONVENTIONAL JET TRANSPORTS             ACPRICE    18
C                IAIRPL = 2 FOR SMALL JET TRANSPORTS                    ACPRICE    19
C                IAIRPL = 3 FOR WIDE BODY JET TRANSPORTS                ACPRICE    20
C                IAIRPL = 4 FOR TURBO-PROP TRANSPORTS                   ACPRICE    21
C                IAIRPL = 5 FOR GENERAL AVIATION TYPES                  ACPRICE    22
C                IAIRPL = 6 FOR SUPERSONIC TRANSPORTS                   ACPRICE    23
C     IENGS      INDICATOR FOR TYPE OF ENGINES                          ACPRICE    24
C                IENG = 1 FOR TURBOJET AND TURBOFAN                     ACPRICE    25
C                IENG = 2 FOR TURBOPROP                                 ACPRICE    26
C                IENG = 3 FOR RECIPROCATING                             ACPRICE    27
C                IENG = 4 FOR AIRBREATHING                              ACPRICE    28
C     NVHF     = TOTAL NUMBER FLIGHT TEST + OPERATIONAL VEHICLES        ACPRICE    29
C                (FROM ACCOST) - NOT USED                               ACPRICE    30
C     PN       = TOTAL PASSENGER CAPACITY > 34" SEAT SPACING            ACPRICE    31
C     T        = THRUST PER ENGINE                                      ACPRICE    32
C     WAIRFR   = AIRFRAME WEIGHT                                        ACPRICE    33
C     WE       = AIRCRAFT EMPTY WEIGHT                                  ACPRICE    34
C     WENGS    = ENGINES TOTAL WEIGHT                                   ACPRICE    35
C     YEAR     = YEAR OF INTRODUCTION INTO SERVICE                      ACPRICE    36
                                                                        ACPRICE    37
      DIMENSION COMENT(8)                                               ACPRICE    38
      DIMENSION ESEPRI(3)                                               ACPRICE    39
      DIMENSION IA(3)                                                   ACPRICE    40
      COMMON / PRICED  / EPRICE                                         ACPRICE    41
                                                                        ACPRICE    42
      DATA ASTOP / 10HZZZZZZZZZZ  /                                     ACPRICE    43
      DATA BSTOP / 10H           /                                      ACPRICE    44
      DATA C / 1.0E-6/                                                  ACPRICE    45
      NAMELIST / IN / API, EN, FCS, IAIRPL, IENGS, NVHF, PN,            ACPRICE    46
     1               T, WE, WENGS, YEAR, HP                             ACPRICE    47
C                                                                       ACPRICE    48
C     PARAMETER INITIALIZATION.  READ COMMENT CARD AND INPUT VARIABLES   ACPRICE    49
C                                                                       ACPRICE    50
   20 IA(1)    = 0                                                      ACPRICE    51
      IA(2)    = 0                                                      ACPRICE    52
      IA(3)    = 0                                                      ACPRICE    53
      API=0.06                                                          ACPRICE    54
      READ (4,5.) COMENT                                                ACPRICE    55
      IF (COMENT(1) .EQ. ASTOP) GO TO 500                               ACPRICE    56
      WRITE (6,55) COMENT                                               ACPRICE    57
      READ (4,IN)                                                       ACPRICE    58
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   50 FORMAT (8A10)
   55 FORMAT (1H1, 10X, 8A10//)
C
C     COMPUTE PRICE ESTIMATES FOR AIRCRAFT AS LABELED BELOW
C
C        I.    COMPARE AIRPLANE DEVELOPMENT COST
C                    TO (TRDTE - PD - PDFEE FROM ACCOST)
      EDEVC    = 129.9 * EXP(0.1097*(YEAR-1940.)) * WE * C
C       II.    COMPARE AIRPLANE UNIT PRODUCTION COST
C                    TO (FVUCA / (1.0+FEE)) FOR NVHF AIRPLANES FROM ACCOST
      EUPPOC   =   7.8 * EXP(0.068 *(YEAR-1940.)) * WE * C
      EPRICE=0.0
      IF(IAIRPL.GT.3) GO TO 104
      GO TO (101, 102, 103), IAIRPL
C      III.    COMPARE AIRPLANE MARKET PLACE PRICE
C                    TO AVUAC VALUE FOR NVHF AIRPLANES FROM ACCOST
C                    EST. MARKET PLACE PRICE FOR IAIRPL = 1
  101 EPRICE   =        0.04867 * PN * (1.0+APT)**(YEAR-1975.)
      GO TO 104
C                    EST. MARKET PLACE PRICE FOR IAIRPL = 2
  102 EPRICE   = 0.5 + 0.0365  * PN * (1.0+APT)**(YEAR-1975.)
      GO TO 104
C                    EST. MARKET PLACE PRICE FOR IAIRPL = 3
  103 EPRICE   = 0.0 + 0.05935 * PN * (1.0+APT)**(YEAR-1975.)
C       IV.    COMPARE AIRPLANE PER SEAT PRICE
C                    TO AVUAC VALUE FOR NVHF AIRPLANES FROM ACCOST
  104 ESEPRI(1) = 3100.0 * PN * EXP(0.0641 * (YEAR-1930.)) * C
      IA(1)    = 1
      IF (IAIRPL .EQ. 3) GO TO 112
      IF (IENGS .EQ. 1) GO TO 113
  105 ESEPRI(2) = 4000.0 * PN * EXP(0.0652 * (YEAR-1930.)) * C
      IA(2)    = 1
  112 IF (IENGS .NE. 1) GO TO 113
  106 ESEPRI(3) = 20500. * PN * EXP(0.0353 * (YEAR-1950.)) * C
      IA(3)    = 1
      EENGPR=0.0
      IF(IENGS.GT.3) GO TO 130
  113 GO TO (121, 122, 123), IENGS
C        V.    COMPARE AIRPLANE MANUFACTURERS PRICE
C                    TO AVUAC VALUE FOR NVHF AIRPLANES FROM ACCOST
C                    ENGINE PRICE FOR IENG = 1
  121 EENGPR   = 111.114 * EN *  T**0.852  * (1.0+APT)**(YEAR-1975.)* C
      GO TO 130
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C                   ENGINE PRICE FOR IENG = 2                              ACPRICE  116
  122 EENGPR  = 473.175 * EN * HP**0.9283 * (1.0+API)**([illegible]-1975.) * C  ACPRICE  117
      GO TO 130                                                            ACPRICE  118
C                   ENGINE PRICE FOR IENG = 3                              ACPRICE  119
  123 EENGPR  =   4.693 * EN * HP**1.3917 * (1.0+API)**(YEAR-1975.) * C    ACPRICE  120
                                                                           ACPRICE  121
  130 WAIRFR  = WE - WENGS                                                 ACPRICE  122
                                                                           ACPRICE  123
      GO TO (131, 132, 133, 134, 135, 136), IAIRPL                         ACPRICE  124
                                                                           ACPRICE  125
C                   AIRFRAME PRICE FOR IAIRPL = 1                          ACPRICE  126
  131 EAIRFR  = 1653.07 * WAIRFR**0.7300 * (1.0+API)**(YEAR-1975.) * C     ACPRICE  127
      GO TO 140                                                            ACPRICE  128
C                   AIRFRAME PRICE FOR IAIRPL = 2                          ACPRICE  129
  132 EAIRFR  =  436.40 * WAIRFR**0.8936 * (1.0+API)**(YEAR-1975.) * C     ACPRICE  130
      GO TO 140                                                            ACPRICE  131
C                   AIRFRAME PRICE FOR IAIRPL = 3                          ACPRICE  132
  133 EAIRFR  = 3603.35 * WAIRFR**0.69823* (1.0+API)**(YEAR-1975.) * C     ACPRICE  133
      GO TO 140                                                            ACPRICE  134
C                   AIRFRAME PRICE FOR IAIRPL = 4                          ACPRICE  135
  134 EAIRFR  = 4878.64 * WAIRFR**0.65969* (1.0+API)**(YEAR-1975.) * C     ACPRICE  136
      GO TO 140                                                            ACPRICE  137
C                   AIRFRAME PRICE FOR IAIRPL = 5                          ACPRICE  138
  135 EAIRFR  = [illegible]3418 * WAIRFR**2.1938 * (1.0+API)**(YEAR-1975.) * C  ACPRICE  139
      GO TO 140                                                            ACPRICE  140
C                   AIRFRAME PRICE FOR IAIRPL = 6                          ACPRICE  141
  136 EAIRFR  = 17689[illegible]. * WAIRFR**0.4506 * (1.0+API)**(YEAR-1975.) * C  ACPRICE  142
                                                                           ACPRICE  143
  140 EAIRPR  = EAIRFR + EENGPR                                            ACPRICE  144
                                                                           ACPRICE  145
      WRITE (6,200) EDEVC, EUPROC, EPRICE, ESEPRT(1)                       ACPRICE  146
  200 FORMAT (1H0, T10, *ESTIMATED AIRPLANE DEVELOPMENT COST, MILLIONS *   ACPRICE  147
     1, T75, F20.4//                                                       ACPRICE  148
     1T10, *ESTIMATED AIRPLANE UNIT PRODUCTION COST, MILLIONS *, T75,      ACPRICE  149
     3F20.4//                                                              ACPRICE  150
     4T10, *ESTIMATED AIRPLANE MARKET PLACE PRICE *, T75, F20.4//          ACPRICE  151
     5T10,*ESTIMATED AIRPLANE PRICE BY SEAT COST, MILLIONS,(ESEPRT(1))*,   ACPRICE  152
     6T85,F10.4/)                                                          ACPRICE  153
      IF (TA(2) .EQ. 0) GO TO 201                                          ACPRICE  154
      WRITE (6,205) ESEPRT(2)                                              ACPRICE  155
  201 IF (TA(3) .EQ. 0) GO TO 202                                          ACPRICE  156
      WRITE (6,206) ESEPRT(3)                                              ACPRICE  157
  202 WRITE (6,210)           EENGPR, EAIRFR, WAIRFR, EAIRPR               ACPRICE  158
  210 FORMAT (1H ,                                                         ACPRICE  159
     3T10, *ESTIMATED ENGINES TOTAL PRICE*,T75,F20.4//                     ACPRICE  160
     4T10, *ESTIMATED AIRFRAME PRICE*, T75, F20.4//                        ACPRICE  161
     5T10, *AIRFRAME WEIGHT*, T75, F20.4//                                 ACPRICE  162
     6T10, *ESTIMATED AIRPLANE PRICE*, T75, F20.4/)                        ACPRICE  163
      DO 400 II=1,8                                                        ACPRICE  164
  400 COMENT(II) = BSTOP                                                   ACPRICE  165
      GO TO 20                                                             ACPRICE  166
  205 FORMAT (                                                             ACPRICE  167
     1T10,*ESTIMATED AIRPLANE PRICE BY SEAT COST, MILLIONS,(ESEPRT(2))*,   ACPRICE  168
     2T85, F10.4/)                                                         ACPRICE  169
  206 FORMAT (                                                             ACPRICE  170
     1T10,*ESTIMATED AIRPLANE PRICE BY SEAT COST, MILLIONS,(ESEPRT(3))*,   ACPRICE  171
     2T85, F10.4/)                                                         ACPRICE  172
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  603 RETURN                                         ACPRICE   173
      END                                            ACPRICE   174
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      SUBROUTINE ACCOST                                               ACCOST     2
C                                                                     ACCOST     3
C     ACCOST IS THE MAJOR COMPONENT IN THE AIRFRAME MANUFACTURERS     ACCOST     4
C     MODULE IN THE ARC-ART MODELS.  THIS SUBROUTINE CONSISTSOF A     ACCOST     5
C     SERIES OF EXPONENTIAL EQUATIONS THAT ESTIMATE ROTE AND COMPONENT ACCOST    6
C     MANUFACTURING COSTS FOR EACH SPECIFIC TYPE OF AIRCRAFT          ACCOST     7
C                                                                     ACCOST     8
                                                                      ACCOST     9
C     AD       = AVIONICS DEVELOPMENT COST                            ACCOST    10
C     ADDE     = TOTAL AIRFRAME DESIGN AND DEVELOPMENT ENGINEERING COST, ACCOST 11
C                INCLUDES CONCEPT FORMULATION AND CONTRACT DEFINITION ACCOST    12
C     ADI      = AVIONICS DEVELOPMENT COST, INPUT VALUE               ACCOST    13
C     AFSPAD   = AIRFRAME SPARES FACTOR, PRODUCTION PHASE, (DEFAULT VALU ACCOST 14
C     AGEO     = OPERATIONAL GROUND SUPPORT EQUIPMENT COST            ACCOST    15
C     AGEOI    = OPERATIONAL GROUND SUPPORT EQUIPMENT COST, INPUT     ACCOST    16
C     AGEP     = GROUND SUPPORT EQUIPMENT DEVELOPMENT COST            ACCOST    17
C     AGEPI    = GROUND SUPPORT EQUIPMENT DEVELOPMENT COST,  INPUT    ACCOST    18
C     AMFG     = AIRFRAME TOTAL COST,  F.U.M.C.                       ACCOST    19
C     AP       = AVERAGE AIRPLANE PRICE FOR 404 UNITS                 ACCOST    20
C     AQ       = PRODUCTION TOTAL COST FOR  NV  AIRPLANES             ACCOST    21
C     AQFEE    = PRODUCTION PHASE CONTRACTOR FEE                      ACCOST    22
C     C        = ARRAY                                                ACCOST    23
C     CACS     = AIR CONDITIONING  SYSTEM COST, F.U.M.C.              ACCOST    24
C     CAERO    = AERODYNAMIC CONTROL SYSTEM COST,  F.U.M.C.           ACCOST    25
C     CAFCT    = CUMMULATIVE TOTAL AIRFRAME COSTS FOR 404 UNITS       ACCOST    26
C     CAFCTI   = CUMMULATIVE TOTAL AIRFRAME COSTS FOR 40-14 UNITS     ACCOST    27
C     CAFFV    = FLIGHT TEST VEHICLE AIRFRAME COS.                    ACCOST    28
C     CAFQ     = PRODUCTION AIRCRAFT AIRFRAME COST                    ACCOST    29
C     CAFUCA   = CUMMULATIVE AVERAGE UNIT AIRFRAME COST FOR #Q# UNITS ACCOST    30
C     CANTIC   = ANTI-ICING COST, F.U.M.C.                            ACCOST    31
C     CAVCT    = CUMMULATIVE TOTAL AVIONICS COSTS FOR 404 UNITS       ACCOST    32
C     CAVCTI   = CUMMULATIVE TOTAL AVIONICS COSTS FOR 40-14 UNITS     ACCOST    33
C     CAVFV    = FLIGHT TEST VEHICLE AVIONICS COST                    ACCOST    34
C     CAVION   = AVIONICS COST,  F.U.M.C.                             ACCOST    35
C     CAVQ     = PRODUCTION AIRCRAFT AVIONICA COST                    ACCOST    36
C     CAVONE   = AVIONICS EQUIPMENT COST, F.U.M.C.                    ACCOST    37
C     CAVONI   = AVIONICS INSTALLATION COST, F.U.M.C.                 ACCOST    38
C     CAVONT   = TOTAL AVIONICS EQUIPMENT AND INSTALLATION COST       ACCOST    39
C     CAVUCA   = CUMMULATIVE AVERAGE UNIT AVIONICS COST FOR 404 UNITS ACCOST    40
C     CBODY    = AIRCRAFT FUSELAGE COST,  F.U.M.C.                    ACCOST    41
C     CD       = CONTRACT DEFINITION PHASE COST                       ACCOST    42
C     CELCAD   = ELECTRICAL DISTRIBUTION SYSTEM COST                  ACCOST    43
C     CEMP     = EMPENNAGE COST, F.U.M.C.                             ACCOST    44
C     CENACC   = ENGINE ACCESSORIES COST,   F.U.M.C.                  ACCOST    45
C     CENGS    = AIRPLANE ENGINES COST,  F.U.M.C.                     ACCOST    46
C     CF       = CONCEPT FORMULATION PHASE COST                       ACCOST    47
C     CFACS    = COMPLEXITY FACTOR AIR CONDITIONING SYSTEM            ACCOST    48
C     CFAERO   = COMPLEXITY FACTOR AERODYNAMIC CONTROL SYSTEM         ACCOST    49
C     CFANTC   = COMPLEXITY FACTOR ANTI-ICING SYSTEM                  ACCOST    50
C     CFASSY   = FINAL ASSEMBLY AND CHECK-OUT COST                    ACCOST    51
C     CFAVON   = COMPLEXITY FACTOR AVIONICS SYSTEM                    ACCOST    52
C     CFBODY   = COMPLEXITY FACTOR AIRCRAFT FUSELAGE                  ACCOST    53
C     CFELCD   = COMPLEXITY FACTOR ELECTRICAL DISTRIBUTION SYSTEM     ACCOST    54
C     CFEMP    = COMPLEXITY FACTOR EMPENNAGE STRUCTURE                ACCOST    55
C     CFENAC   = COMPLEXITY FACTOR ENGINE ACCESSORIES                 ACCOST    56
C     CFENG    = COMPLEXITY FACTOR AIRBREATHING ENGINES               ACCOST    57
C     CFFUSY   = COMPLEXITY FACTOR FUEL SYSTEM                        ACCOST    58
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C      CFHNDL   = COMPLEXITY FACTOR FOR LOADING AND HANDLING               ACCOST     49
C      CFHYCD   = COMPLEXITY FACTOR HYDRAULIC SYSTEM                       ACCOST     50
C      CFINST   = COMPLEXITY FACTOR INSTRUMENT SYSTEM                      ACCOST     51
C      CFLG     = COMPLEXITY FACTOR ALIGHTING GEAR SYSTEM                  ACCOST     52
C      CFNAC    = COMPLEXITY FACTOR ENGINE NACELLES                        ACCOST     53
C      CFPACC   = COMPLEXITY FACTOR PASSENGER ACCOMMODATIONS               ACCOST     54
C      CFPNCD   = COMPLEXITY FACTOR PNEUMATIC SYSTEM                       ACCOST     55
C      CFPOW    = COMPLEXITY FACTOR AUXILIARY POWER SYSTEM                 ACCOST     56
C      CFTREV   = COMPLEXITY FACTOR THRUST REVERSER                        ACCOST     57
C      CFUSYS   = FUEL SYSTEM COST,  F.U.M.C.                              ACCOST     58
C      CFWING   = COMPLEXITY FACTOR WING STRUCTURE                         ACCOST     59
C      CHANDL   = LOAD AND HANDLING SYSTEM COST, F.U.M.C.                  ACCOST     60
C      CHYCAD   = HYDRAULIC SYSTEM COST,  F.U.M.C.                         ACCOST     61
C      CINST    = INSTRUMENT SYSTEM COST,  F.U.M.C.                        ACCOST     62
C      CINSTE   = INSTRUMENT EQUIPMENT COST, F.U.M.C.                      ACCOST     63
C      CINSTI   = INSTRUMENT INSTALLATION COST, F.U.M.C.                   ACCOST     64
C      CLG      = ALIGHTING GEAR COST,  F.U.M.C.                           ACCOST     65
C      CNACEL   = ENGINE NACELLES COST,  F.U.M.C.                          ACCOST     66
C      CONFIG   = ENGINEERING COMPLEXITY FACTOR,  NOMINALLY IS 1.0          ACCOST     67
C      CPACCO   = PASSENGER ACCOMMODATIONS AND FURNISHING COST,  F.U.M.C.  ACCOST     68
C      CPCT     = CUMMULATIVE TOTAL PROPULSION COSTS FOR 404 UNITS         ACCOST     69
C      CPCTT    = CUMMULATIVE TOTAL PROPULSION COSTS FOR 40-14 UNITS       ACCOST     70
C      CPFV     = FLIGHT TEST VEHICLE PROPULSION SYSTEM COST               ACCOST     81
C      CPNCAD   = PNEUMATIC SYSTEM COST, F.U.M.C.                          ACCOST     82
C      CPO      = PRODUCTION AIRCRAFT PROPULSION SYSTEM COST               ACCOST     83
C      CPOWER   = AUXILIARY POWER SYSTEM COST,  F.U.M.C.                   ACCOST     84
C      CPUCA    = CUMMULATIVE AVERAGE UNIT PROPULSION COST FOR 404 UNITS   ACCOST     85
C      CSTRUC   = ASSEMBLED AIRPLANE COST,  F.U.M.C.                       ACCOST     86
C      CTJ      = AIRPLANE ENGINE UNIT COST,  F.U.M.C.                     ACCOST     87
C      CTJI     = AIRPLANE ENGINE UNIT COST, INPUT VALUE,  F.U.M.C.        ACCOST     88
C      CTREVS   = THRUST REVERSER COST, F.U.M.C.                           ACCOST     89
C      CV       = TOTAL AIRCRAFT COST,  F.U.M.C.                           ACCOST     90
C      CWING    = WING COST,  F.U.M.C.                                     ACCOST     91
C      DDEL     = AIRFRAME DESIGN AND DEVELOPMENT ENGINEERING COST         ACCOST     92
C      DS       = RESEARCH, DEVELOPMENT, TEST & EVALUATION SUPPORT         ACCOST     93
C      EN       = NUMBER OF MAIN ENGINES = NENG                            ACCOST     94
C      ENSPAD   = MAIN ENGINE SPARES FACTOR,  PRODUCTION PHASE             ACCOST     95
C      ENSPAR   = MAIN ENGINE SPARES FACTOR,  RDT+E PHASE                  ACCOST     96
C      FAC      = PRODUCTION FACILITIES COST                               ACCOST     97
C      FACT     = PRODUCTION FACILITIES COST,  INPUT VALUE                 ACCOST     98
C      FEE      = MANUFACTURER FEE FACTOR,  NOMINAL VALUE = 0.10           ACCOST     99
C      FTO      = FLIGHT TEST OPERATION COST                               ACCOST    100
C      FTOT     = FLIGHT TEST OPERATION COST, INPUT VALUE                  ACCOST    101
C      FTS      = FLIGHT TEST AIRCRAFT SPARES COST                         ACCOST    102
C      FV       = FLIGHT TEST VEHICLES COST                                ACCOST    103
C      FVCT     = CUMMULATIVE TOTAL AIRPLANE COSTS FOR 404 UNITS           ACCOST    104
C      FVCTT    = CUMMULATIVE TOTAL AIRPLANE COSTS FOR 40-14 UNITS         ACCOST    105
C      FVSPAR   = FLIGHT TEST VEHICLE SPARES,  NOMINAL VALUE = 0.20        ACCOST    106
C      FVUC     = UNIT AIRPLANE COST OF 40-TH4 UNIT                        ACCOST    107
C      FVUCA    = CUMMULATIVE AVERAGE UNIT AIRPLANE COST FOR 404 UNITS     ACCOST    108
C      GTS      = GROUND TEST VEHICLE SPARES COST                          ACCOST    109
C      GTSPAR   = GROUND TEST VEHICLE SPARES,  NOMINAL VALUE = 0.10        ACCOST    110
C      GTV      = GROUND TEST VEHICLES                                     ACCOST    111
C      T        = INDICATOR FOR QUANTITIES MATRIX                          ACCOST    112
C      ICONFG   = INDICATOR FOR AIRCRAFT TYPE,  ( =6  FOR SUBSONIC         ACCOST    113
C                 PRODUCTION, =7  PROTOTYPE, =8  SUPERSONIC PRODUCTION)    ACCOST    114
C      ICUM     = INDICATOR FOR CUMMULATIVE QUANTITY                       ACCOST    115
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C       IDATA    = INDICATOR FOR PRINTOUT FORMAT                             ACCOST   116
C                  =1 FOR NORMAL PRINT OUT                                   ACCOST   117
C       IOPS     = INDICATOR FOR TYPE OPERATIONAL PROGRAM                    ACCOST   118
C                  =1 FOR COMMERCIAL AIRLINE, =0 FOR OTHER                   ACCOST   119
C       IPOWER   = INDICATOR FOR TYPE ELECTRICAL POWER SYSTEM                ACCOST   120
C                  =1 FOR BATTERY, =2 FOR AIRCRAFT APU                       ACCOST   121
C       IPROD    = INDICATOR FOR PROTOTYPE OR PRODUCTION TOOLING             ACCOST   122
C                  =1 FOR PRODUCTION, (NORMAL SETTING)  =0 FOR PROTOTYPE     ACCOST   123
C       IQ       = INDICATOR FOR QUANTITY MATRIX                             ACCOST   124
C       IT       = INITIAL FLIGHT CREW TRAINING COST FOR  NV  AIRPLANES      ACCOST   125
C       IV       = TOTAL AIRCRAFT PRODUCTION COSTS FOR  NV  AIRPLANES        ACCOST   126
C       IWLG     = INDICATOR FOR LANDING GEAR COMPONENT BREAKDOWN            ACCOST   127
C       J        = INDICATOR                                                 ACCOST   128
C       LEARN    = AIRFRAME LEARNING CURVE, PERCENT                          ACCOST   129
C       LEARNA   = AVIONICS LEARNING CURVE, PERCENT                          ACCOST   130
C       LEARNP   = ENGINE LEARNING CURVE, PERCENT                            ACCOST   131
C       MACH     = MAXIMUM DESIGN FLIGHT MACH NUMBER FOR ENGINES             ACCOST   132
C       MEQ      = MISCELLANEOUS EQUIPMENT COST                              ACCOST   133
C       N        = INDICATOR                                                 ACCOST   134
C       NCREW    = NUMBER IN FLIGHT CREW, PER AIRPLANE                       ACCOST   135
C       NDATA    = NUMBER OF POSITIONS ON LEARNING CURVE                     ACCOST   136
C                  AT LEAST 1 POSITION,  ( < OR = 5 )                        ACCOST   137
C       NFV      = NUMBER FLIGHT TEST VEHICLES                               ACCOST   138
C       NG       = NUMBER OF GROUND TEST VEHICLES                            ACCOST   139
C       NOCON    = NUMBER OF CONCEPT FORMULATION CONTRACTORS                 ACCOST   140
C       NOCON1   = NUMBER OF CONTRACT DEFINITION CONTRACTORS                 ACCOST   141
C       NOENG    = NUMBER OF CONCEPT FORMULATION ENGINEERS                   ACCOST   142
C       NOENG1   = NUMBER OF CONTRACT DEFINITIONS ENGINEERS                  ACCOST   143
C       NOYRS    = NUMBER OF YEARS FOR CONCEPT FORMULATION                   ACCOST   144
C       NOYRS1   = NUMBER OF YEARS FOR CONTRACT DEFINITIONS                  ACCOST   145
C       NPL      = TOTAL NUMBER FLIGHT CREW PERSONNEL TO BE TRAINED          ACCOST   146
C       NV       = NUMBER OPERATIONAL VEHICLES                               ACCOST   147
C       NVEH     = NUMBER OF VEHICLE AT EACH POINT ON LEARNING CURVE         ACCOST   148
C                  =1 FOR FIRST UNIT COST                                    ACCOST   149
C       NVHF     = TOTAL NUMBER FLIGHT TEST + OPERATIONAL VEHICLES           ACCOST   150
C       OS       = OPERATIONAL VEHICLES SPARES COST                          ACCOST   151
C       OSA      = PRODUCTION AIRFRAME SPARES                                ACCOST   152
C       OSP      = PRODUCTION ENGINE SPARES                                  ACCOST   153
C       OT       = TRAINING EQUIPMENT COST                                   ACCOST   154
C       OV       = OPERATIONAL VEHICLES COSTS                                ACCOST   155
C       PDTJ     = PROPULSION DEVELOPMENT COST TURBO-JET ENGINES             ACCOST   156
C       PDTJI    = PROPULSION DEVELOPMENT COST TURBO-JET ENGINES, INPUT VA   ACCOST   157
C       PN       = TOTAL NUMBER OF PASSENGERS                                ACCOST   158
C       PROPU    = TOTAL PROPULSION SYSTEM COST,  F.O.M.C.                   ACCOST   159
C       Q        = TOTAL NUMBER OF VEHICLES MANUFACTURED IN QUANTITY MATRI   ACCOST   160
C       RATE     = VEHICLE PRODUCTION RATE, NUMBER/MONTH                     ACCOST   161
C       RDFEE    = CONTRACTOR FEE,  RDT + E PHASE                            ACCOST   162
C       RDTE     = RESEARCH, DEVELOPMENT, TESTING + ENGINEERING COST         ACCOST   163
C       RE       = ENGINEERING LABOR RATE,  $/ HR.                           ACCOST   164
C       RT       = TOOLING LABOR RATE,  $/ HR.                               ACCOST   165
C       SC       = TOTAL MANUFACTURING SUSTAINING COSTS FOR 404 UNITS        ACCOST   166
C       SE       = SUSTAINING ENGINEERING COSTS                              ACCOST   167
C       ST       = SUSTAINING TOOLING COST                                   ACCOST   168
C       SUBSYS   = SUBSYSTEM DEVELOPMENT COST                                ACCOST   169
C       SUBSYI   = SUBSYSTEM DEVELOPMENT COST,  INPUT VALUE                  ACCOST   170
C       T        = THRUST PER ENGINE = TPEREN (SEA LEVEL)                    ACCOST   171
C       TDD      = PRODUCTION AIRCRAFT TECHNICAL DATA COST                   ACCOST   172
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C      TDP      = ROTAL TECHNICAL DATA COST                                    ACCOST    173
C      TMC      = TOTAL OF ALL MANUFACTURING COSTS FOR TOT UNITS               ACCOST    174
C      TOOLC    = COMPLEXITY FACTOR TOOLING                                    ACCOST    175
C      TOVERW   = TOTAL ENGINE THRUST OVER AIRPLANE TAKE OFF GROSS WEIGHT      ACCOST    176
C      TPEREN   = THRUST IN POUNDS PER ENGINE                                  ACCOST    177
C      TRDTE    = TOTAL RESEARCH, DEVELOPMENT, TOOLING & ENGINEERING COST      ACCOST    178
C      TRDTEC   = ARRAY OF RDTE COST FACTORS                                   ACCOST    179
C      TRI      = INITIAL TRANSPORTATION COST                                  ACCOST    180
C      TST      = TOOLING AND SPECIAL EQUIPMENT COST                           ACCOST    181
C      TTLCMP   = ARRAY OF PRODUCTION COST FACTORS                             ACCOST    182
C      VMAX     = MAXIMUM VEHICLE SPEED, KNOTS                                 ACCOST    183
C      VA       = VEHICLE AMPR WEIGHT                                          ACCOST    184
C      WACS     = AIR CONDITIONING SYSTEM WEIGHT                               ACCOST    185
C      WAERO    = AERODYNAMIC CONTROL SYSTEM WEIGHT                            ACCOST    186
C      WANTIC   = ANTI-ICING SYSTEM WEIGHT                                     ACCOST    187
C      WAVION   = AVIONICS SYSTEM WEIGHT                                       ACCOST    188
C      WAVIOT   = TOTAL AVIONICS AND INSTRUMENT WEIGHT                         ACCOST    189
C      WBODY    = FUSELAGE WEIGHT                                              ACCOST    190
C      WE       = AIRCRAFT EMPTY WEIGHT                                        ACCOST    191
C      WELCAD   = ELECTRIC POWER CONVERSION & DISTRIBUTION SYSTEM WEIGHT       ACCOST    192
C      WEMP     = EMPENNAGE WEIGHT                                             ACCOST    193
C      WENACC   = ENGINE ACCESSORIES WEIGHT                                    ACCOST    194
C      WENGS    = ENGINES TOTAL WEIGHT                                         ACCOST    195
C      WFUSYS   = FUEL SYSTEM WEIGHT                                           ACCOST    196
C      WFUTOT   = TOTAL FUEL WEIGHT                                            ACCOST    197
C      WGROSS   = AIRCRAFT GROSS TAKE-OFF WEIGHT = WG = WTO                    ACCOST    198
C      WHANDL   = LOAD AND HANDLING SYSTEM WEIGHT                              ACCOST    199
C      WHYCAD   = HYDRAULIC POWER CONVERSION & DISTRIBUTION SYSTEM WEIGHT      ACCOST    200
C      WINST    = INSTRUMENT SYSTEM WEIGHT                                     ACCOST    201
C      WLG      = ALIGHTING GEAR SYSTEM WEIGHT                                 ACCOST    202
C      WLGCON   = ALIGHTING GEAR CONTROLS WEIGHT                               ACCOST    203
C      WLGSTR   = ALIGHTING GEAR STRUCTURE WEIGHT                              ACCOST    204
C      WLGTRS   = TIRE WEIGHT                                                  ACCOST    205
C      WLGWHL   = WHEELS AND BRAKE WEIGHT                                      ACCOST    206
C      WNACEL   = ENGINE NACELLES WEIGHT                                       ACCOST    207
C      WPACCO   = PASSENGER ACCOMODATIONS (AND EQUIPMENT) WEIGHT               ACCOST    208
C      WPAYL    = PAYLOAD WEIGHT                                               ACCOST    209
C      WPNCAD   = PNEUMATIC POWER AND DISTRIBUTION SYSTEM WEIGHT               ACCOST    210
C      WPOWER   = AUXILIARY POWER SYSTEM WEIGHT                                ACCOST    211
C      WPPROV   = CREW SIZE RELATED SUBSYSTEM DEVELOPMENT COST FACTOR          ACCOST    212
C      WTREVS   = THRUST REVERSER WEIGHT                                       ACCOST    213
C      WWING    = WING WEIGHT                                                  ACCOST    214
C      XAVD     = AVIONICS DEVELOPMENT FACTOR,  NOMINAL VALUE = 0.10           ACCOST    215
C      XFC??Y   = FINAL ASSEMBLY-CHECK OUT COST FRACTION,  NOMINAL VALUE       ACCOST    216
C      X        = MISCELLANEOUS EQUIPMENT DEVELOPMENT FACTOR,  VALUE = 0.      ACCOST    217
C      Z        = AIRFRAME PRODUCTION LEARNING CURVE COST FACTOR               ACCOST    218
C      ZA       = AVIONICS PRODUCTION LEARNING CURVE COST FACTOR               ACCOST    219
C      ZETA     = AIRFRAME LEARNING CURVE EXPONENT                             ACCOST    220
C      ZETAA    = AVIONICS LEARNING CURVE EXPONENT                             ACCOST    221
C      ZETAP    = ENGINE   LEARNING CURVE EXPONENT                             ACCOST    222
C      ZP       = ENGINE PRODUCTION LEARNING CURVE COST FACTOR                 ACCOST    223
                                                                               ACCOST    224
       REAL LEARN, LEARNP, IV, MEO, IT, MACH                                   ACCOST    225
       REAL NVEH, NG, NEV, NV, NCREW, NPL, NVHF, LEARNA                        ACCOST    226
       REAL NOENS,NOYRS,NOCON,NOENG1,NOYRS1,NOCON1                             ACCOST    227
       DIMENSION TRDTEC (31),TTLCMP (11)                                       ACCOST    228
       COMMON /TRDTEC / TRDTEC                                                 ACCOST    229
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```
      COMMON /TTLCMP / TTLCMP
      COMMON /MAXP / MAXP
      COMMON /TOTAL/ ITOTAL

      COMMON / COSTOT / AD, ADDF, AGEO, AGEP, AO, AOFEE, C(37,5),
     1                  CD, CF, DDEL, DS, FAC, FTS, FTO, FV, GTS, GTV,
     2                  IT, MEQ, NDATA, NEV, NG, NV, NVEH(5), OS, OT,
     3                  OV, POTJ, RDFEE, SE, ST, SUBSYS, TOD, TUP, NVHF,
     4                  TPDTE, TRE, TST

      COMMON / CUMOUT / AP, CAFUCA, CAVUCA, CPUCA, FEE, FVCT, FVUC,
     X                  FVUCA, I, ICUM, IPROD, IO(33), MACH, RATE,
     2                  SC, TMC, WA, WGROSS

      COMMON / CSHFLD / CAVION, AMFG, PROPU, XFASSY, ENSPAD, LEARN,
     1                  LEARNA, LEARNP

      DATA  TO/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60, 70,
     1          80, 90, 100, 200, 300, 400, 500, 600, 700, 800, 900,
     2          1000, 1200, 1400, 1600, 1800, 2000/
C
C     INITIALIZE PARAMETER DEFAULT VALUES
C

      DATA AFSPAD / 0.13 /, CFHNDL /1.0/, PN / 1.0/
      DATA NVEH/5*1.0/
      DATA ADI, AGEOI, AGEPI, FTOI, POTJI/5*0.10/
      DATA CFACS, CFAERO, CFANTC, CFAVON, CFBODY, CFELCD, CFEMP, CFENAC,
     1     CFENG, CFFUSY, CFHYCD, CFINST, CFLG,
     2     CFNAC, CFPACC, CFPNCD, CFPOW, CFTREV, CFWING, CTJI/20*1.0/
      DATA FACI /0.0/, FEE /0.10/, FVSPAR /0.20/, GTSPAR /0.10/
      DATA CONFIG /1.0/,            EN /4.0/, ENSPAR /0.4/, ENSPAR/0.4/
      DATA ICONFG /6/, IDATA /1/, IOPS/0/, IPOWER /2/, IPROD /1/
      DATA LEARN, LEARNA, LEARNP, MACH, NCREW, NDATA, NEV,
     1     NG, NOCON, NOCON1, NOENG, NOENG1, NOYRS, NOYRS1, NV,
     2     RAYE, RE, RT, SUBSYI,           TOOLC, WACS, WLG, WPAYL,
     3     XAVD, XFASSY, XNEW/ 2030.0,90.0,  0.80, 1.0, 5, 1.0, 1.0,
     4     280.0,  150.0, 500.0,  0.75, 1.0,  1.0, 1.0, 17.0, 15.0,
     5         0.0, 1.0, 450.0, 0.35, 0.20/
      DATA WAERO, WANTIC, WAVION, WBODY, WELCAD, WEMP,
     1     WENACC, WENGS, WFUSYS, WFUTOT, WGROSS, WHANDL, WHYCAD,
     2     WINST, WLGCON, WLGSTR, WLGTRS, WLGWHL, WNACEL, WPACCO,
     3     WPNCAD, WPOWER, WTREVS, WWING / 24*0.0 /, IWLG /0/

      NAMELIST /INPUT1/ EN, MACH, PN, T, WACS, WAERO, WANTIC, WAVION,
     1                  WBODY, WELCAD, WEMP, WENACC,
     2                  WENGS, WFUSYS, WFUTOT, WGROSS, WHANDL,
     3                  WHYCAD, WINST, WLG, WLGCON, WLGSTR, WLGTRS,
     4                  WLGWHL, WNACEL, WPACCO, WPNCAD, WPOWER, WTREVS,
     5                  WWING, WPAYL, IWLG

      NAMELIST /INPUT2/ ADI, AGEOI, AGEPI, CFACS, CFAERO, CFANTC,
     1                  CFAVON, CFBODY, CFELCD, CFEMP, CFENAC, CFENG,
     2                  CFFUSY, CFHNDL, CFHYCD, CFINST, CFLG, CFNAC,
     3                  CFPACC, CFPNCD, CFPOW, CFTREV, CFWING,  CONFIG,
     4                  CTJI, AFSPAD,     PAD, ENSPAR, FACI, FEE, FTOI,
     5                  FVSPAR, GTSPAR, ICONFG, IDATA, IPOWER, IPROD,
```

```
     6              IOPS, LLEARN, LEARNA, LEARNP, NCREW, NDATA, NEV,
     7              NG, NOCON, NOCON1, NOENG, NOENG1, NOYRS, NOYRS1,
     8              NV, NVEH, POTJT, RATE, RE, RT, SUBSYT,
     9              TOOLC, XAVD, XFASSY, XNEW
C
C     READ AND WRITE INPUT PARAMETERS TO BE OVERRIDEN
C

      READ (4,INPUT1)
      READ (4,INPUT2)
      RATE = MAXP
      WRITE (6,INPUT1)
      WRITE (6,INPUT2)
      IF (IWLG .GE. 1)
     *WLG     = WLGSTR + WLGCON + WLGWHL + WLGTRS

      WRITE (6,21) (NVEH(J),J=1,5),NDATA,  ICONFG, IDATA, IPOWER, IPROD
   21 FORMAT (1H0, 4X, 6HNVEH =, 5F15.1/ 4X, 7HNDATA =, I3, 4X,
     18HICONFG =, I3, 4X, 7HIDATA =, I3, 4X, 8HIPOWER =, I3, 4X,
     27HIPROD =, I3)
      WRITE (6,22)  ADI, NG, CONFIG, LEARN,  NOCON, NOCON1,
     1              FACI, NV, ENSPAD,LEARNP, NOENG, NOENG1,
     2              FEF, PE, ENSPAR,LEARNA,  NOYRS, NOYRS1,
     3              MACH,RT, FTOI,   NEV,  XNEW, XAVD,
     4              RATE,    TOOLC,  CFACS,  XFASSY
   22 FORMAT (/ 5X, *ADI  =*, F8.3,5X, *NG =*, F8.3, 6X,
     1                             *CONFIG =*, F8.3, 6X, *LEARN =*,
     1F8.3, 6X, *NOCON =*, F8.3, 6X, *NOCON1 =*, F8.3/ 5X, *FACI =*,
     2F8.3, 6X, *NV =*, F8.3, 6X,*ENSPAD =*,F8.3,6X,    *LEARNP=*, F8.3,
     36X, *NOENG =*, F8.3, 6X, *NOENG1 =*, F8.3/
     3                                   5X, *FEF  =*, F8.3, 6X, *RE =
     4*, F8.3, 6X, *ENSPAR =*, F8.3, 6X,*LEARNA=*,F8.3,6X,    *NOYRS =*,
     5F8.3, 6X, *NOYRS1 =*, F8.3/5X, *MACH =*, F8.3, 6X,*RT =*, F8.3, 6X
     5,*FTOI  =*, F8.3, 6X, *NEV   =*, F8.3, 6X,*XNEW  =*, F8.3,
     *6X, *XAVD   =*, F8.3/
     7                    5X, *RATE =*, F8.3, 24X, *TOOLC  =*, F8.3, 6X,
     8*CFACS =*, F8.3, 5X, *XFASSY =*, F8.3 /)
      WRITE (6,25) AGEDI, FVSPAR, PDTJ, SUBSYS, IOPS, PN,
     1              AGEPI, GTSPAR, PDTJI, SUBSYT,NCREW
   25 FORMAT (5X, *AGEDI =*, F8.3,6X, *FVSPAR =*, F8.3, 6X, *PDT   =*,
     1F8.3,6X,*SUBSYS =*,F8.3, 6X,*IOPS =*, I6, 6X, *PN    =*, F8.3/
     25X,    *AGEPI =*, F8.3, 6X, *GTSPAR =*, F8.3, 6X, *PDTJT =*,
     3F8.3, 6X, *SUBSYT =*, F8.3, 26X,
     4*NCREW =*, F3.3/)
      WRITE (6,23) CFAERO, CFANTC, CFAVON, CFBODY, CFELCD,
     1CFENG, CFEMP, CFENAC, CFHYCD, CFFUSY, CFINST, CFLG,
     2CFNAC, CFPNCD, CFPOW, CFHNDL, CFTREV, CFWING, CFPACC, CFACS
   23 FORMAT (13X,                          8HCFAERO =, F7.3, 5X,
     18HCFANTC =, F7.3, 5X, 8HCFAVON =, F7.3, 5X, 8HCFBODY =, F7.3, 5X,
     28HCFELCD =, F7.3/ 13X, 8HCFENG  =, F7.3, 5X, 8HCFEMP  =, F7.3, 5X,
     3                8HCFENAC =, F7.3, 5X,  8HCFHYCD =, F7.3, 5X,
     48HCFFUSY =, F7.3/ 13X, 8HCFINST =, F7.3, 5X,
     58HCFLG   =, F7.3, 5X,                   8HCFNAC  =, F7.3,
     65X, 8HCFPNCD =, F7.3, 5X, 8HCFPOW  =, F7.3/
     713X, 8HCFHNDL =,F7.3, 5X, 8HCFTREV =, F7.3, 5X, 8HCFWING =,
     8F7.3, 5X, 8HCFPACC =, F7.3, 5X, 8HCFACS  =, F7.3)
```

```
      T       = 0.
      ICUM    = 0
      J       = 0
C  MANUFACTURING COST BREAKDOWN
      TPEREN=T
      TOVERW = TPEREN * EN   / WGROSS
      WRITE(5,500) TOVERW,EN
  500 FORMAT(*CTOVERW=*,E12.5,5X,*EN = *, E12.5)
C   LEARNING CURVE EXPONENT
    8 ZETA=1.0+(ALOG(.01*LEARN))/ALOG(2.))
C
      IF (LEARNA .EQ. 0.) ZETAA = ZETA
      IF (LEARNA .EQ. 0.) GO TO 9
      ZETAA = 1.0 + (ALOG(.01*LEARNA)/ALOG(2.0))
    9 ZETAP=1.0+(ALOG(.01*LEARNP)/ALOG(2.))
C
C     FIRST OF TWO MAJOR PROGRAM LOOPS.  ONE CYCLE FOR EACH
C     POSITION ON LEARNING CURVE.
C

      DO 999 N=1,NDATA
C
      DO 3332 J=1,37
 3332 C(J,N)=0.
C
      Z = NVEH(N)**ZETA
      ZA = NVEH(N)**ZETAA
      ZP = NVEH(N)**ZETAP
      WPPROV = NCREW * 500. - 500.
C
C          AIRPLANE STRUCTURE
C
C              1. WING GROUP
      CWING = 36000. * WWING**.451 * Z * CFWING
C              2. TAIL GROUP
      CEMP = 10230. * WEMP**.451 * Z * CFEMP
C              3. BODY GROUP
      CBODY=56100.*WBODY**.451*Z*CFBODY
C              4. ALIGHTING GEAR GROUP STRUCTURE
      CLG  = 10430. * WLG**.541 * Z * CFLG
C              5. NACELLE GROUP
      CNACEL=56130.*WNACEL**.451*Z*CFNAC
C              6. PROPULSION GROUP
C                    ENGINES
      CTJ  =2770.*T**.60*ZP*CFENG
      IF (CTJI .NE. 1.) CTJ = CTJI
      CENGS = CTJ * EN
C                    THRUST REVERSER
      CTREVS   = 2800.0 * WTREVS**0.766 * ZP * CFTREV
C                    ENGINE ACCESSORIES
      CENACC  = 129.0 * WENACC * ZP * CFENAC
C                    FUEL SYSTEM
      CFUSYS  = 51.9 * WFUSYS * ZP * CFFUSY
C                    PROPULSION GROUP TOTAL
```


C-2

```
      PROPU   = CENGS + CTREVS + CFISYS + CENACC
C           7. SURFACE CONTROLS GROUP
      CAERO=4.1.0*WACRO**Z*CFAERO

C        AIRPLANE SYSTEMS
C
C           8. HYDRAULIC GROUP
      CHYCAD=1973.*WHYCAD**.765*Z*CFHYCD
C           9. ELECTRICAL GROUP
      CELCAD = 1973. * WELCAD**0.765 * Z * CFELCD
C          10. PNEUMATIC GROUP
      CPNCAD  = 200.0 * WPNCAD * Z * CFPNCD
C          11. AIR CONDITIONING GROUP
      CACS = 6432.0 * WACS**0.5065 * Z * CFACS
C          12. ANTI-ICING GROUP
      CANTIC  = 230.0 * WANTIC * Z * CFANTC
C          13. AUXILIARY POWER GROUP
      CPOWER  = 243.0 * WPOWER * Z * CFPOW
C          14. FURNISHINGS AND EQUIPMENT GROUP
      CPACCO  = 115.0 * WPACCO *Z * CFPACC
C          15. INSTRUMENTS
C                EQUIPMENT
      CINSTE  = 1930.0 * (WINST/2.0) * ZA * CFINST
C                INSTALLATION
      CINSTI  = 154.0 * (WINST/2.0) * ZA * CFINST
C                INSTRUMENT GROUP TOTAL
      CINST   = CINSTE + CINSTI
C          16. AVIONICS GROUP
C                EQUIPMENT
      CAVONE  = 1930.0 * (WAVION/2.0) * ZA * CFAVON
C                INSTALLATION
      CAVONI  = 154.0 * (WAVION/2.0) * ZA * CFAVON
C                AVIONICS GROUP TOTAL
      CAVONT  = CAVONE  +  CAVONI
C          17. LOAD AND HANDLING GROUP
      CHANDL  = (WHANDL / WBODY) * CBODY * CFHNDL


C        AIRPLANE ASSEMBLY
C        AIRFRAME
      AMFG = CWING + CEMP + CBODY + CLG + CAERO + CNACEL + CPOWER +
     1        CACS + CHYCAD + CPACCO + CELCAD + CPNCAD + CANTIC + CHANDL
C        AVIONICS
      CAVION  = CINST  +  CAVONT
C        TOTAL ASSEMBLY COST
      CSTRUC = AMFG + CAVION + PROPJ
C        AIRPLANE CHECKOUT
      CFASSY=FASSY*CSTRUC
C        TOTAL AIRLINE MODEL COST
      CV = CSTRUC + CFASSY
C
      C(2,N)=CBODY
      C(4,N) = CLG
      C(5,N)=CENGS
      C( 6,N) = CAVONI
      C(7,N)=CTREVS
```

```
      C(8,N)=CNACEL                                                     ACCOST   458
      C(09,N) = CPNCAD                                                  ACCOST   459
      C(10,N) = AMFG                                                    ACCOST   460
      C(11,N) = CAVION                                                  ACCOST   461
      C(12,N) = PROPU                                                   ACCOST   462
      C(13,N) = CV                                                      ACCOST   463
      C(14,N)=CFUSYS                                                    ACCOST   464
      C(15,N) = CANTIC                                                  ACCOST   465
      C(16,N) = CHANDL                                                  ACCOST   466
      C(19,N)=CAERO                                                     ACCOST   467
      C(20,N) = CENACC                                                  ACCOST   468
      C(21,N)=CPOWER                                                    ACCOST   469
      C(22,N) = CAVONT                                                  ACCOST   470
      C(23,N)=CINSTE                                                    ACCOST   471
      C(24,N)=CINST                                                     ACCOST   472
      C(25,N) = CHYCAD                                                  ACCOST   473
      C(26,N) = CELCAD                                                  ACCOST   474
      C(27,N) = CINSTI                                                  ACCOST   475
      C(28,N) = CACS                                                    ACCOST   476
      C(29,N)= CPACCD                                                   ACCOST   477
      C(30,N)=CAVONE                                                    ACCOST   478
      C(31,N) = CSTRUC                                                  ACCOST   479
      C(32,N)=CSTRUC+CFASSY                                             ACCOST   480
      C(33,N) = CFASSY                                                  ACCOST   481
      C(34,N) = CWING                                                   ACCOST   482
      C(35,N) = CEMP                                                    ACCOST   483
      C(37,N)=CFASSY                                                    ACCOST   484
C                                                                       ACCOST   485
C   ALL COSTS BEYOND THIS POINT ARE IN MILLIONS OF DOLLARS              ACCOST   486
      DO 999 J=1,37                                                     ACCOST   487
  998 C(J,N)=C(J,N)*1.E-6                                               ACCOST   488
C                                                                       ACCOST   489
  999 CONTINUE                                                          ACCOST   490
C                                                                       ACCOST   491
C     END OF FIRST MAJOR LOOP.  SET INITIAL VALUES FOR SECOND MAJOR     ACCOST   492
C     LOOP                                                              ACCOST   493
C                                                                       ACCOST   494
                                                                        ACCOST   495
      AMFG = C(10,1)                                                    ACCOST   496
      CAVION = C(11,1)                                                  ACCOST   497
      PROPU = C(12,1)                                                   ACCOST   498
      VMAX = 660.0 * MACH                                               ACCOST   499
      WE = WGROSS - WPAYL - WFUTOT                                      ACCOST   500
      NVHF = NV + NFV                                                   ACCOST   501
      NPL      = NCREW + NVHF * 2.0                                     ACCOST   502
      WAVIOT   = WAVION + WINST                                         ACCOST   503
      WA = WE - WENGS - WELCAD - WAVIOT - WACS - WPOWER                 ACCOST   504
                                                                        ACCOST   505
C   AIRFRAME DESIGN AND DEVELOPMENT ENGINEERING(ADDE)                   ACCOST   506
C     CONCEPT FORMULATION(CF)                                           ACCOST   507
      CF=35000.*NDENG*NDYRS*NOCON*1.E-06                                ACCOST   508
C     CONTRACT DEFINITION(CD)                                           ACCOST   509
      CD=3500..*NDENG1*NDYRS1*NOCON1*1.E-06                             ACCOST   510
C                                                                       ACCOST   511
C     DESIGN AND DEVELOPMENT ENGINEERING LABOR(DDEL)                    ACCOST   512
C                                                                       ACCOST   513
C  ICONFG =          6 FOR SUBSONIC PRODUCTION A/C.                     ACCOST   514
```

```
C  7 FOR SUBSONIC PROTOTYPE A/C, 9 FOR SUPERSONIC PRODUCTION A/C
C
      GO TO (205,205,205,205,205,205,207,209),ICONFG
C
  205 DDEL=207.*WA**.931*RE*1.E-6*CONFIG
      GO TO 213
  207 DDEL=RE*3145.*WA**.5825*1.E-6*CONFIG
      GO TO 203
  209 DDEL=RE*344.*WA**.931*1.E-5*CONFIG
  213 ADDE=CF+CO+DDEL
C
C     SUBSYSTEM DEVELOPMENT
      SUBSYS = 30.35 * (WACS + WINST*0.5 + WPOWER + WELCAD + WAERO
     1 + WHYCAD + WPNCAD + WENACC + WFUSYS + WPPROV) * XNEW
C
      IF (SUBSYI .NE. 0.0) SUBSYS=SUBSYI
C
C     AVIONICS DEVELOPMENT(AD)
      AD =    (5.3 * (WAVION*(.75)**.439 + 2.19 * (0.25*WAVION)**0.439
     1          + 3.55 * (0.50*WINST)**0.439) * XAVD
      IF(ADI.NE..1) AD=ADI
C
C     PROPULSION DEVELOPMENT-     TURBOJET OR TURBOFAN  (PDTJ),
C
C     SECOND MAJOR PROGRAM LOOP,  CYCLE ONCE FOR ACTUAL TOTAL OF
C     AIRCRAFT TO BE PRODUCED AND THEN 33 CYCLES FOR ARRAY OF
C     PRESET NUMBERS OF AIRCRAFT TO BE PRODUCED
C
110   CONTINUE
  100 PDTJ=29.5*(T/1000.)**.55*MACH**.62*( NVHF   *FN*(1.+ENSPAR
     **ENSPAD))**0.1
      IF (ICUM .GE. 1) GO TO 122
      WRITE (6,501) T, MACH, NV, NFV, EN, ENSPAR, ENSPAD, AFSPAD
  501 FORMAT(*DT=*,F8.1, 5X,*MACH=*,F8.3, 5X,*NV=*,F8.3, 5X,*NFV=*,F8.3,
     1 5X, *EN=*, F8.3/  * ENSPAR=*, F8.3, 5X, *ENSPAD=*, F8.3, 5X,
     2 *AFSPAD=*, F8.3)
      IF(PDTJI.NE..1) PDTJ=PDTJI
      WRITE (6,502) PDTJ
  502 FORMAT (* PDTJ = *, E12.5)
C
C     FLIGHT TEST VEHICLES(FV)
      CAFFV = AMFG * NFV**ZETA
      CAVFV =CAVION * NFV**ZETAA
      CPFV = PROPU * NFV**ZETAP
      FV = (CAFFV + CAVFV + CPFV) * (1.0 + XFASSY)
C
C     GROUND TEST VEHICLES (GTV)
    6 GTV=   AMFG * NG
C
C     TOOLING AND SPECIAL EQUIPMENT(TST)
      GO TO (30,31,31,31,31,32,30,32), ICONFG
   30 TST=PT*6.19*WA**1.062*TOOLC*1.E-6
      GO TO 34
   31 TST = 45.0 * PT * WA**1.062 * TOOLC * 1.E-6
      GO TO 33
   32                                           TST=PT*.0267*
     * WA**.99*VMAX**1.21*RATE**.4*NFV**.14*TOOLC*1.E-6
```

```
   33 IF(IPROD.EQ.0)
     *TST=RT*6.19*WA**1.062*TOOLC*1.E-6
C
C
C   AIRCRAFT TYPE FLIGHT TEST PROGRAM
C     FLIGHT TEST OPERATIONS(FTO)
   34 FTO=.90*NFV**1.1*       VMAX**.9*1.E-6 * WGROSS**.8
      IF(FTOI .NE..1) FTO=FTOI
C
C     AGE(AGEP)
      AGEP=.15*FV+.(5*ADDE
      IF (AGEPI .NE. 0.1) AGEP = AGEPI
C
C     TECHNICAL DATA(TDP)
      TDP=.02*FV
C
C     GROUND TEST SPARES(GTS)
      GTS = GTV * GTSPAR
C
C     FLIGHT TEST SPARES(FS)
      FTS= FV * FVSPAR
C
C   INITIAL INVESTMENT(IV)
C
C     OPERATIONAL VEHICLE(OV)
  120 CONTINUE
C
  125 CAFO     = NVHF**ZETA * AMFG
      CAVO     = CAVION * NVHF**ZETAA
      CPO      = PROPU * NVHF**ZETAP
  130 OV       = (CAVO + CAFO + CPO) * (1.0 + XFASSY)
C
C     AGE
      AGEO     = 0.15 * OV
      IF (AGEOI .NE. 0.1) AGEO = AGEOI
C
C     SPARES(OS)
      OSA      = AFSPAO * (CAFO + CAVO)
      OSP = PROPU * ((NVHF + (1.0+ENSPAO))**ZETAP - NVHF**ZETAP)
      OS = OSA + OSP
      IF (IOPS .EQ. 1) OS = 0.
C
C     FACILITIES(FAC)  INPUT
      FAC = FACT
C
C     SUSTAINING ENGINEERING(SE)

      SE       = ADDE * (NVHF**.20 -1.0)
      IF(IOPS.EQ.1) SE=.10*OV
C
C     SUSTAINING TOOLING(ST)
      ST       = TST * (( NVHF ) ** 0.14 - 1.0 )
      GO TO 176
C
C     TECHNICAL DATA(TDO)
  176 TDO      = 0.02 * OV
C
```

ORIGINAL PAGE IS OF POOR QUALITY

```
C     MISCELLANEOUS EQUIPMENT(MEQ)                                      ACCOST   629
      MEQ = 500. * NPL* 4. * 10.**(-C6)                                 ACCOST   630
      IF(IOPS.EQ.1) MEQ=0.                                              ACCOST   631
C                                                                       ACCOST   632
C   TRAINING EQUIPMENT (OT)                                             ACCOST   633
      OT      = 1.442E-1 *  OV * NV4F**(-0.4525)                        ACCOST   634
      IF (IOPS.EQ.1) OT=0.                                              ACCOST   635
C     INITIAL TRAINING(IT)                                              ACCOST   636
      IT=NPL*.05                                                        ACCOST   637
      IF (IOPS.EQ.1) IT=0.                                              ACCOST   638
C                                                                       ACCOST   639
C     INITIAL TRANSPORTATION(TRI)                                       ACCOST   640
      TRI=.005*(DV+DS+MEQ+ OT+AGEO)                                     ACCOST   641
C                                                                       ACCOST   642
C                                                                       ACCOST   643
      IV      = DV + DS + FAC + ST + SE + TDO + MEO + OT + IT + TRI+AGEO ACCOST   644
C                                                                       ACCOST   645
C                                                                       ACCOST   646
C        BASIC RESEARCH, DEVELOPMENT, AND ENGINEERING COSTS             ACCOST   647
      RDTE = CF + CD + DDEL + SUBSYS + AD + PDTJ + GTV + GTS + FTS+ TST ACCOST   648
     ** FTO + AGEP + TDP                                                ACCOST   649
C                FEE                                                    ACCOST   650
      RDFEE=RDTE*FEE                                                    ACCOST   651
C        TOTAL RESEARCH, DEVELOPMENT, TEST, AND EVALUATION COSTS        ACCOST   652
      TRDTE=RDTE+RDFEE                                                  ACCOST   653
      IF (ICUM .GT. 1) GO TO 196                                        ACCOST   654
C                                                                       ACCOST   655
C     CONTRACTOR FEE                                                    ACCOST   656
      AOFEE=IV*FEE                                                      ACCOST   657
C                                                                       ACCOST   658
C     TOTAL PRODUCTION COSTS                                            ACCOST   659
      AO=IV+AOFEE                                                       ACCOST   660
      DS = GTV + GTS + FTS + TST + FTO + AGEP + TDP                     ACCOST   661
      IF (ICUM .EQ. 0) GO TO 196                                        ACCOST   662
  193 CAFUCA  = AMFG * Q**(ZETA-1.0)                                    ACCOST   663
      CAVUCA  = CAVION * Q**(ZETAA-1.0)                                 ACCOST   664
      CPUCA   = PROPU * Q**(ZETAP-1.0)                                  ACCOST   665
      FVUCA   = (CAFUCA + CAVUCA + CPUCA) * (1.0+XFASSY) * (1.0+FEE)    ACCOST   666
      CAFCT   = AMFG * Z                                                ACCOST   667
      CAVCT   = CAVION * ZA                                             ACCOST   668
      CPCT    = PROPU * ZP                                              ACCOST   669
      FVCT    = (CAFCT + CAVCT + CPCT) * (1.0 + XFASSY) * (1.0 + FEE)   ACCOST   670
      IF (ICUM .EQ. 1) GO TO 195                                        ACCOST   671
      CAFCTI  = AMFG      * (Q-1.)**ZETA                                ACCOST   672
      CAVCTI  = CAVION      * (Q-1.)**ZETAA                             ACCOST   673
      CPCTI   = PROPU      * (Q-1.)**ZETAP                              ACCOST   674
      FVCTI   = (CAFCTI + CAVCTI + CPCTI) * (1.0 + XFASSY) * (1.+FEE)   ACCOST   675
      FVUC    = FVCT - FVCTI                                            ACCOST   676
  195 IF (ICUM .EQ. 1) FVUC = FVCT                                      ACCOST   677
      SC      = ( IV - DV ) * ( 1.0 + FEE )                             ACCOST   678
      THC     = FVCT +TRDTE + SC                                        ACCOST   679
      AP      = THC / Q                                                 ACCOST   680
  196 CALL COSTPO                                                       ACCOST   681
      I = I + 1                                                         ACCOST   682
      Q       = IQ(I)                                                   ACCOST   683
      NVHF    = 0                                                       ACCOST   684
      IF (NVHF .GT. NEV) NV = Q - NEV                                   ACCOST   685
```

```
            NPL     = NCREW + Q + 2.0                          ACCOST   686
            Z       = Q**ZETA                                  ACCOST   687
            ZA      = Q**ZETAA                                 ACCOST   688
            ZP      = Q**ZETAP                                 ACCOST   689
            ICUM    = ICUM + 1                                 ACCOST   690
            IF (ICUM.NL.1)  GO TO 200                          ACCOST   691
            TTLCMP (1)    = C(13,2)                            ACCOST   692
            TTLCMP (2)    = OS                                 ACCOST   693
            TTLCMP (3)    = FAC                                ACCOST   694
            TTLCMP (4)    = SE                                 ACCOST   695
            TTLCMP (5)    = ST                                 ACCOST   696
            TTLCMP (6)    = AGEO                               ACCOST   697
            TTLCMP (7)    = TDO                                ACCOST   698
            TTLCMP (8)    = MEO                                ACCOST   699
            TTLCMP (9)    = OT                                 ACCOST   700
            TTLCMP (10)   = IT                                 ACCOST   701
            TTLCMP (11)   = TRI                                ACCOST   702
            TRDTEC(1)=ADDE                                     ACCOST   703
            TRDTEC(2)=SUBSYS                                   ACCOST   704
            TRDTEC(3)=AD                                       ACCOST   705
            TRDTEC(4)=POTJ                                     ACCOST   706
            TRDTEC(5)=OS                                       ACCOST   707
      200   CONTINUE                                           ACCOST   708
            IF (ICUM .GT. 33)  GO TO 300                       ACCOST   709
            GO TO 110                                          ACCOST   710
      C                                                        ACCOST   711
      C     END OF SECOND MAJOR PROGRAM LOOP                   ACCOST   712
      C                                                        ACCOST   713
      300   CONTINUE                                           ACCOST   714
            RETURN                                             ACCOST   715
            END                                                ACCOST   716
```

```
      SUBROUTINE COSTPR
C
C     THIS SUBROUTINE PRINTS COST FACTORS DEVELOPED BY
C     SUBROUTINE ACCOST
C


      DIMENSION PR(2)
      COMMON / CUMOUT / AP, CAFUCA, CAVUCA, CPUCA, FEE, FVCT, FVUC,
     X                  FVUCA, I, ICUM, IPROD, IO(33), MACH, RATE,
     2                  SC, TMC, WA, WGROSS

      COMMON / COSTOT / AO, ADDE, AGED, AGEP, AQ, AQFEE, C(37,5),
     1                  CD, CF, DDEL, DS, FAC, FTS, FTO, FV, GTS, GTV,
     2                  IT, MEQ, NDATA, NEV, NG, NV, NVEH(5), OS, OT,
     3                  OV, POTJ, POFEE, SE, ST, SUBSYS, TDO, TOP, NVHF,
     4                  TROTS, TRI, TST

      DIMENSION TITLE(8)
      REAL NVEH, NEV, NG, NV, NVHF, IT, MEQ

      DATA PR/10HPRODUCTION , 10HPROTOTYPE  /

      FEEI = FEE*100.
      PRI     = PR(1)
      IF (IPROD .EQ. 0) PRI = PR(2)
      IF (ICUM .GT. 0) GO TO 700
C
C     WRITE BREAKDOWN OF CUMULATIVE MANUFACTURING COSTS ONLY ON FIRST
C     CYCLE OF ACCOST
C

      READ (4,29) (TITLE(I),I=1,8,1)
   29 FORMAT(8A10)
      WRITE (6,30) (TITLE(I),I=1,8)
   30 FORMAT (1H1, 26X, 8A10//)
      WRITE(6,35)
      WRITE(6,899)(NVEH(N),N=1,NDATA)
      WRITE (6,801) (C(34,N),N=1,NDATA)
      WRITE (6,802) (C(35,N),N=1,NDATA)
      WRITE(6,800) (C(2,N),N=1,NDATA)
   55 WRITE(6,2100) (C(4,N),N=1,NDATA)
      WRITE(6,3100) (C(6,N),N=1,NDATA)
      WRITE(6,2800) (C(12,N),N=1,NDATA)
      WRITE(6,2900) (C(3,N),N=1,NDATA)
      WRITE(6,3300) (C(7,N),N=1,NDATA)
      WRITE(6,3600) (C(14,N),N=1,NDATA)
      WRITE(6,2970) (C(20,N),N=1,NDATA)
      WRITE(6,4200) (C(19,N),N=1,NDATA)
      WRITE(6,5950) (C(25,N),N=1,NDATA)
      WRITE(6,5430) (C(26,N),N=1,NDATA)
      WRITE(6,3330) (C(9,N),N=1,NDATA)
      WRITE(6,6000) (C(23,N),N=1,NDATA)
      WRITE(6,6100) (C(15,N),N=1,NDATA)
      WRITE(6,4900) (C(21,N),N=1,NDATA)
      WRITE(6,6500) (C(29,N),N=1,NDATA)
```

```
          WRITE(6,5800) (C(24,N),N=1,NDATA)                             COSTPR    59
          WRITE(6,5700) (C(23,N),N=1,NDATA)                             COSTPR    60
          WRITE(6,5900) (C(27,N),N=1,NDATA)                             COSTPR    61
          WRITE(6,7100) (C(22,N),N=1,NDATA)                             COSTPR    62
          WRITE(6,7100) (C(30,N),N=1,NDATA)                             COSTPR    63
          WRITE(6,6300) (C(36,N),N=1,NDATA)                             COSTPR    64
          WRITE(6,6200) (C(16,N),N=1,NDATA)                             COSTPR    65
      156 WRITE (6,7260) (C(37,N),N=1,NDATA)                            COSTPR    66
          WRITE(6,7261) (C(32,N),N=1,NDATA)                             COSTPR    67
       35 FORMAT(1H0, 32X,                                              COSTPR    68
         144HBREAKDOWN OF CUMULATIVE MANUFACTURING COST,        , 3X,   COSTPR    69
         220HMILLIONS OF DOLLARS         )                              COSTPR    70
      800 FORMAT(1H0,52HBODY STRUCTURE                                  COSTPR    71
         15F14.4)                                                       COSTPR    72
      801 FORMAT(1H0,52HWING                                            COSTPR    73
         15F14.4)                                                       COSTPR    74
      802 FORMAT(1H0,52HEMPENNAGE                                       COSTPR    75
         15F14.4)                                                       COSTPR    76
      809 FORMAT(1H0, 52HNUMBER OF VEHICLES                             COSTPR    77
         15F14.0)                                                       COSTPR    78
     2100 FORMAT(1H0,52HLANDING GEAR                                    COSTPR    79
         15F14.4)                                                       COSTPR    80
     2800 FORMAT(1H0,52HPROPULSION SYSTEM                               COSTPR    81
         13H  (, F11.4, 1H), 4(2H (, F11.4, 1H)))                       COSTPR    82
     2870  FORMAT(1H ,52H    ENGINE ACCESSORIES                         COSTPR    83
         15F14.4)                                                       COSTPR    84
     2900 FORMAT(1H ,52H    ENGINES                                     COSTPR    85
         15F14.4)                                                       COSTPR    86
     3000 FORMAT(1H ,52H    THRUST REVERSER                             COSTPR    87
         15F14.4)                                                       COSTPR    88
     3100 FORMAT(1H0,52HNACELLES, PODS, PYLONS, SUPPORTS                COSTPR    89
         15F14.4)                                                       COSTPR    90
     3300  FORMAT(1H0,52HPNEUMATIC                                      COSTPR    91
         15F14.4)                                                       COSTPR    92
     3600 FORMAT(1H ,52H    FUEL SYSTEM                                 COSTPR    93
         15F14.4)                                                       COSTPR    94
     4200 FORMAT(1H0,52HAERODYNAMIC CONTROLS (SURFACE CONTROLS)         COSTPR    95
         15F14.4)                                                       COSTPR    96
     4900 FORMAT(1H0,52HAUXILIARY POWER SOURCE                          COSTPR    97
         15F14.4)                                                       COSTPR    98
     5400 FORMAT(1H0,52HELECTRICAL POWER CONVERSION AND DISTRIBUTION    COSTPR    99
         15F14.4)                                                       COSTPR   100
     5950 FORMAT (1H0, 53HHYDRAULIC                                     COSTPR   101
         1,2X,5F14.4)                                                   COSTPR   102
     5700 FORMAT(1H ,52H    EQUIPMENT                                   COSTPR   103
         15F14.4)                                                       COSTPR   104
     5800 FORMAT(1H0,52HINSTRUMENTATION                                 COSTPR   105
         13H  (, F11.4, 1H), 4(2H (, F11.4, 1H)))                       COSTPR   106
     5900 FORMAT(1H ,52H    INSTALLATION                                COSTPR   107
         15F14.4)                                                       COSTPR   108
     6000 FORMAT(1H0,52HAIR CONDITIONING                                COSTPR   109
         15F14.4)                                                       COSTPR   110
     6100 FORMAT(1H0,52HANTI-ICING                                      COSTPR   111
         15F14.4)                                                       COSTPR   112
     6200 FORMAT(1H0,52HLOAD AND HANDLING                               COSTPR   113
         15F14.4)                                                       COSTPR   114
     6300 FORMAT(1H ,52H    INSTALLATION                                COSTPR   115
```

```
      15F14.4)
 660  FORMAT(1H ,52HPASSENGER ACCOMMODATIONS
      15F14.4)
 7100 FORMAT(1H0,52HAVIONICS
      13H  (, F11.4, 1H), 4(2H (, F11.4, 1H)))
 7103 FORMAT(1H ,52H     EQUIPMENT
      15F14.4)
 7201 FORMAT(1H0,52HVEHICLE TOTAL
      15F14.4)
 7205 FORMAT(1H0,52HFINAL ASSEMBLY AND CHECKOUT
     * 5F14.4)
C
    1 WRITE (6,192)TRDTE,ADDE,CF,CD,CDEL
  192 FORMAT(1H1,53X,25HCOST(MILLIONS OF DOLLARS)/
     141H RESEARCH,DEVELOPMENT,TEST,AND EVALUATION,77X,F12.2/
     221H ,10X,43HAIRFRAME DESIGN AND ENGINEERING DEVELOPMENT,37X,F12.2/
     331H ,20X,19HCONCEPT FORMULATION,31X,F12.2/
     441H ,20X,19HCONTRACT DEFINITION,31X,F12.2/
     5 1H ,20X,20HAIRFRAME ENGINEERING, 30X,F12.2 )
      WRITE(6,193) SUBSYS
  193 FORMAT(
     * 1H ,10X,35HSUBSYSTEMS DEVELOPMENT               , 45X, F12.2)
      WRITE(6,194) AD, PDTJ, DS
  194 FORMAT(
     61H ,10X,20HAVIONICS DEVELOPMENT,60X, F12.2/
     71H ,10X,22HPROPULSION DEVELOPMENT,58X, F12.2/
     81H ,10X,19HDEVELOPMENT SUPPORT, 61X, F12.2)
      WRITE(6,200) NG, GTV
  200 FORMAT(
     11H ,20X,22HGROUND TEST VEHICLES (,F4.1, 1H), 23X,F12.2 )

      WRITE (6,301) GTS, FTS,TST, FTO, AGEP, TDP, RDFEE
      WRITE (6,440) C(13,1), C(10,1), C(11,1), C(12,1)
      WRITE (6,435) C(37,1)
      WRITE (6,445) AO, NVHF, OV

  301 FORMAT(
     21H ,20X,19HGROUND TEST SPARES,32X,F12.2/
     41H ,20X,18HFLIGHT TEST SPARES, 32X, F12.2/
     51H ,20X,34HTOOLING AND SPECIAL TEST EQUIPMENT,16X,F12.2/
     71H ,20X,22HFLIGHT TEST OPERATIONS,  28X,F12.2/
     11H ,20X,50HGROUND SUPPORT EQUIPMENT
     1,F12.2/
     21H ,20X,14HTECHNICAL DATA,36X,F12.2/
     *1H , 10X, 3HFEE, 77X, F12.2//)
  445 FORMAT( 1H ,
     3 20HAIRCRAFT PRODUCTION, 98X, F12.2/
     41H ,10X,22HOPERATIONAL VEHICLES (,F6.1, 1H), 51X, F12.2)
  435 FORMAT (
     *1H , 30X, 30HFINAL ASSEMBLY AND CHECKOUT   , 1H(, F12.2, 1H)//)
  440 FORMAT (1H ,
     *     13X,27H(MANUFACTURING--FIRST UNIT),23X,1H(,F12.2,1H)/
     *1H ,30X,14HAIRFRAME       ,16X,1H(,F12.2,1H) /
     71H ,30X,20HAVIONICS PROCUREMENT,10X,1H(,F12.2,1H)/
     91H ,30X 22HPROPULSION PROCUREMENT,8X,1H(,F12.2,1H))

      WRITE(6,433)
```

```
     305 ,FAC ,          SE  ,ST, AGED, TOD ,MEO , OT, IT  ,TRI ,
     * AOFEE
 400 FORMAT(
     51H ,10X,6HSPARES,74X,F12.2/
     61H ,10X,10HFACILITIES,70X,F12.2/
     91H ,10X,22HSUSTAINING ENGINEERING 58X,F12.2/
     71H ,10X,18HSUSTAINING TOOLING, 62X, F12.2/
     11H ,10X,24HGROUND SUPPORT EQUIPMENT       ,56X, F12.2/
     21H ,10X,14HTECHNICAL DATA,66X,F12.2/
     31H ,10X,23HMISCELLANEOUS EQUIPMENT,57X,F12.2/
     41H , 10X,18HTRAINING EQUIPMENT, 62X,F12.2/
     51H ,10X,16HINITIAL TRAINING,64X,F12.2/
     61H ,10X,22HINITIAL TRANSPORTATION,58X,F12.2/
     81H , 10X, 3HFEE, 77X, F12.2/)

      TOTAL=TRDTE+AO
      AVJAC = TOTAL/NVHF
      WRITE (6,415) TOTAL, NVHF, AVJAC
 415 FORMAT(1H0, 10HTOTAL COST, 107X, F12.2//
     141HOTOTAL NUMBER OF FLIGHT VEHICLES PRODUCED, 77X, F12.2//
     227H0AVERAGE UNIT AIRPLANE COST , 91X, F12.2)

      WRITE (6,416)
 416 FORMAT(1H1)
      RETURN
 700 IF (ICUM .GT. 1) GO TO 735
C
C     WRITE HEADINGS ONLY FOR SECOND CALL FROM ACCOST
C
      WRITE (6,710)
      WRITE (6,720) W, MACH, WGROSS, NV,  RATE, NFV, PRI, FEEI
      WRITE (6,730)

 710 FORMAT (1H , 46X, *AIRPLANE COST VERSUS QUANTITY *//)
 720 FORMAT (1H , 15X, *AMPR WEIGHT (LBS)*, F10.0, 8X,  *MACH NO.*,
     1 F7.2, 8X, *TAKE-OFF GROSS WT. (LBS)*, F10.0// 5X, *NO. AIRCRAFT*,
     2F8.0, 4X, *PRODUCTION RATE AC/MO*, F5.2, 4X, *TEST AC*, F5.0, 4X,
     3*PROGRAM TYPE*, 2X, A10, 4X, *PERCENT PROFIT*, F8.1///)
 730 FORMAT (1H , T21, *AVERAGE MANUFACTURING COSTS*,
     1                       T75, *R D T - E*, T98, *SUSTAINING*,
     2       T101, *AVERAGE*/
     3       T2, *QUANTITY*, T13, *AIRFRAME*, T24, *PROPULSION*,
     4       T37, *AVIONICS*, T48, *UNIT COST*, T62, *CUMULATIVE*, T77,
     5       *COSTS*, T90, *COSTS*, T103, *COST*//)
C
C     WRITE COST VERSUS QUANTITY DATA FOR ALL CALLS AFTER THE
C     FIRST (ACCOST)
C
 735 WRITE (6,740) IO(I), CAFUCA, CPUCA, CAVUCA, FVUCA, FVCT, TRDTE,
     1              SC, AP
 740 FORMAT (1H , T2, I6, T11, F13.4, T22, F10.4, T33, F13.4,
     1T47, F8.2, T61, F13.2, T74, F10.2, T87, F10.2, T98, F10.2)

 503 RETURN
      END
```

```
      SUBROUTINE UNIT04                                                 UNIT04   2
C                                                                       UNIT04   3
C     THIS SUBROUTINE COPIES SOME OF THE CARD INPUT TO DISK UNITS       UNIT04   4
C     FUTURE USE                                                        UNIT04   5
C                                                                       UNIT04   6
      DIMENSION CARD(8)                                                 UNIT04   7
   10 CONTINUE                                                          UNIT04   8
      READ (5,1) CARD                                                   UNIT04   9
      IF (EOF(5)) 99,20                                                 UNIT04  10
   20 CONTINUE                                                          UNIT04  11
C                                                                       UNIT04  12
C     TITLE INFORMATION IS WRITTEN ON UNIT 4 FOR USE IN SUBROUTINE      UNIT04  13
C     COSTPR                                                            UNIT04  14
C                                                                       UNIT04  15
      WRITE (4,1) CARD                                                  UNIT04  16
    1 FORMAT(8A10)                                                      UNIT04  17
      GO TO 10                                                          UNIT04  18
   99 CONTINUE                                                          UNIT04  19
   30 CONTINUE                                                          UNIT04  20
      READ (5,1) CARD                                                   UNIT04  21
      IF (EOF(5)) 199,40                                                UNIT04  22
   40 CONTINUE                                                          UNIT04  23
C                                                                       UNIT04  24
C     PRICE INFORMATION IS WRITTEN ON UNIT 8 FOR USE IN SUBROUTINE      UNIT04  25
C     IMPLANT                                                           UNIT04  26
C                                                                       UNIT04  27
      WRITE (8,1) CARD                                                  UNIT04  28
      GO TO 30                                                          UNIT04  29
  199 CONTINUE                                                          UNIT04  30
      REWIND 8                                                          UNIT04  31
      REWIND 4                                                          UNIT04  32
      RETURN                                                            UNIT04  33
      END                                                               UNIT04  34
```

Appendix E

LISTING OF PROGRAM SOURCE CODE FOR THE AIR CARRIER MODULE

```
      PROGRAM OPLIFE (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
C     PROGRAM DCFROI (INPUT, OUTPUT, TAPE5=INPUT, TAPE6=OUTPUT)
C DCF/ROI ECONOMIC MODEL
C
C     MAIN CONTROL FOR AIR CARRIER MODULE
C
      DIMENSION NAME (122)
      LEVEL 2,
     X            AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,     CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,     DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,          INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,       PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,       SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,     STDEP,    SYNTRS,   YNTRST,
     7COST,       PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25)
      COMMON/IN/AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,     CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,     DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,          INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,       PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,       SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,     STDEP,    SYNTRS,   YNTRST,
     7COST.       PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      REAL INTINV,INCTAX,NTEARN
C
C     SET INITIAL AIRCRAFT PRICE AND CALL INPUTS
C
      PRICE(1,1)=5000000.
      CALL INPUTS(NAME)
      DO 31 M=1,NAC
      WRITE (6,32) (INTINV(I,M),I=1,IYEAR)
   32 FORMAT (* INTINV= *,10E12.4)
   31 CONTINUE
C
C     MAIN LOOP POINT - CYCLE MAIN PROGRAM FOR SUCCESSIVE AIRCRAFT
C     PRICES
C
C     WE HAVE ASSUMED THE RATIOS 2.6 AND 1.5 USED IN THE NEXT TWO LINES
   39 INTINV(1,1)=PRICE(1,1)/2.6
      COST(1,1)=1.5*INTINV(1,1)
C
C     CALL REPAY, DEPSUB AND NETSUB FOR EACH YEAR UNDER STUDY.
C     THEN CALL REST OF SUBROUTINES FOR THIS CYCLE
C
```

ORIGINAL PAGE IS OF POOR QUALITY

```
      DO 2 I=1,IYEAR                                                     OPLIFE      59
      CALL REPAY                                                         OPLIFE      60
      CALL DEPSUB                                                        OPLIFE      61
      CALL NETSUB                                                        OPLIFE      62
    2 CONTINUE                                                           OPLIFE      63
      CALL SUM                                                           OPLIFE      64
      CALL CFSUB                                                         OPLIFE      65
      CALL TAX                                                           OPLIFE      66
      CALL CFSUB                                                         OPLIFE      67
      CALL DCFSUB                                                        OPLIFE      68
      CALL OUTPUT                                                        OPLIFE      69
C                                                                        OPLIFE      70
C     INCREMENT AIRCRAFT PRICE AND RECYCLE UNTIL PRICE LIMIT IS REACHED  OPLIFE      71
C                                                                        OPLIFE      72
      PRICE(1,1)=PRICE(1,1)+2500000.                                     OPLIFE      73
      IF(PRICE(1,1).GT.30000000.) GO TO 29                               OPLIFE      74
      GO TO 39                                                           OPLIFE      75
   29 STOP                                                               OPLIFE      76
      END                                                                OPLIFE      77
```

```
      SUBROUTINE INPUTS(NAME)
C
C     THIS SUBROUTINE CAUSES THE INITIALIZATION OF BASIC PARAMETERS AND
C     THE DIRECT AND INDIRECT OPERATING COST VALUES
C
      DIMENSION
     2MINFL(25),DOC1(100),IOC1(100),DOC(25,100),IOC(25,100)
      REAL INTINV,INCTAX,NTEARN
      DIMENSION NAME(122)
      LEVEL 2,
     X    AREV,CF,CSAREV,CSCF,CSDCF,CSDEPR,CSEBIT,CSEBT,CSINTI,CSINTX,
     1CSNTRN,CSOPCT,CSPRIN,CSYNTR,DCF,DEPR,DEPREC,EBIAT,EBT,ECLIFE,
     2I,INCTAX,INTINV,IYEAR,NAC,NTEARN,OPCOST,PRIN,PV,R,SALVAG,SAREV,
     3SDEPR,SEBIAT,SEBT,SINCTX,SINTIN,SNTERN,SOPCST,SPRIN,SSALVG,
     4SSTDEP,STDEP,SYNTRS,YNTRST,COST,PRICE,RES,RRATE,TXRATE,BVALUE
      DIMENSION AREV(25,100),CF(25),COST(25,100),DCF(25),DEPR(25,100),
     1EBIAT(25,100),EBT(25,100),ECLIFE(100),INCTAX(25,100),
     2INTINV(25,100),NTEARN(25,100),OPCOST(25,100),PRIN(25,100),
     3PV(25),RES(100),RRATE(100),SALVAG(25,100), STDEP(25,100),
     4YNTRST(25,100),SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),
     5SOPCST(25),SDEPR(25),SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),
     6SINCTX(25),SNTERN(25),DEPREC(25),PRICE(25,100),CSDCF(25),
     7SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     8CGTX(25,100),SCGTX(25)
      COMMON/IN/AREV,CF,CSAREV,CSCF,CSDCF,CSDEPR,CSEBIT,CSEBT,CSINTI,
     1CSINTX,CSNTRN,CSOPCT,CSPRIN,CSYNTR,DCF,DEPR,DEPREC,EBIAT,EBT,
     2ECLIFE,I,INCTAX,INTINV,IYEAR,NAC,NTEARN,OPCOST,PRIN,PV,R,
     3SALVAG,SAREV,SDEPR,SEBIAT,SEBT,SINCTX,SINTIN,SNTERN,SOPCST,SPRIN,
     4SSALVG,SSTDEP,STDEP,SYNTRS,YNTRST,COST,PRICE,RES,RRATE,TXRATE,
     5BVALUE
      LEVEL 2, DOC,IOC
      COMMON/DOC/DOC
      COMMON/IOC/IOC
C
C     INITIALIZE BASIC AIR CARRIER MODULE PARAMETERS
C
      IYEAR=15
      NAC=1
       TXRATE=0.48
C     WE HAVE ASSUMED THE RATIOS 2.6 AND 1.5 USED IN THE NEXT 2 LINES
      INTINV(1,1)=PRICE(1,1)/2.5
      COST(1,1)=1.5*INTINV(1,1)
      DO 20 I=1,IYEAR
       MINFL(I)=1.0
      AREV(I,1)=7500000.
   20 CONTINUE
      DO 11 M=1,NAC
      DO 10 I=2,IYEAR
       COST(I,M)= 0.
       INTINV(I, M )=0
C     PRICE OF AIRCRAFT INCREASED BY MINFL FOR SUBSEQUENT YEARS
       PRICE(I, M )=PRICE(I-1,M)*MINFL(I)
   10 CONTINUE
   11 CONTINUE
      DO 31 M=1,NAC
      WRITE (6,32) (INTINV(I,M),I=1,IYEAR)
   32 FORMAT (* INTINV= *,10E12.4)
```

```
   31   CONTINUE                                                   INPUTS    59
        DO 30 M=1,NAC                                              INPUTS    60
C       ECONOMIC LIFE OF EACH AIRCRAFT ASSUMED TO BE 15 YEARS      INPUTS    61
         ECLIFE(M)=15.                                             INPUTS    62
         RES(M)=0.15                                               INPUTS    63
         KRATE(M)=0.1                                              INPUTS    64
   30    CONTINUE                                                  INPUTS    65
C                                                                  INPUTS    66
C       CALL SUBROUTINES TO INPUT AND CALCULATE DIRECT AND INDIRECT INPUTS   67
C       OPERATING EXPENSES                                         INPUTS    68
C                                                                  INPUTS    69
        CALL            DIRECT(DOC1,NAC)                           INPUTS    70
        CALL            INDIR(IOC1,NAC)                            INPUTS    71
C                                                                  INPUTS    72
C       APPLY INFLATION FACTOR TO DIRECT AND INDIRECT COSTS, THEN SUM INPUTS 73
C       THEM INTO OPCOST AND PRINT THE SUM                         INPUTS    74
C                                                                  INPUTS    75
        DO 50 M=1,NAC                                              INPUTS    76
        DOC(1,M)=DOC1(M)                                           INPUTS    77
        IOC(1,M)=IOC1(M)                                           INPUTS    78
        DO 40 I=2,IYEAR                                            INPUTS    79
         DOC(I,M)=DOC(I-1,M)*HINFL(I)                              INPUTS    80
         IOC(I,M)=IOC(I-1,M)*HINFL(I)                              INPUTS    81
   40   CONTINUE                                                   INPUTS    82
   50   CONTINUE                                                   INPUTS    83
        DO 60 M=1,NAC                                              INPUTS    84
        DO 70 I=1,IYEAR                                            INPUTS    85
         OPCOST(I,M)=DOC(I,M)+IOC(I,M)                             INPUTS    86
   70   CONTINUE                                                   INPUTS    87
   60   CONTINUE                                                   INPUTS    88
         WRITE(6,91)                                               INPUTS    89
   91    FORMAT (*1*,* OPCOST(S)  *)                               INPUTS    90
         DO 80 M=1,NAC                                             INPUTS    91
         WRITE(6,51) (OPCOST(I,M),I=1,IYEAR)                       INPUTS    92
    51 FORMAT(1H ,10F12.0)                                         INPUTS    93
   80    CONTINUE                                                  INPUTS    94
        RETURN                                                     INPUTS    95
        END                                                        INPUTS    96
```

```
      SUBROUTINE DIRECT (DOC1,NAC)
      DIMENSION DOC1(100)
C    THIS IS THE DOC PROGRAM FOR AMES STUDY  (1976)
C
C      INPUT BASIC DIRECT COST PARAMETERS, THEN CALCULATE BASIC DIRECT
C      OPERATING COSTS PER AIRCRAFT
C
      DIMENSION S(12),BT(12),BF(12),FLTT(12),SL(12),CRT(12),CFC(12),
     1CFD(12),CI(12),CFDP(12),CLA(12),CMA(12),CLE(12),CME(12),CMB(12),
     2CM(12),CD(12),CAM(12),CFM(12),CBM(12),CASM(12)
      DIMENSION XNAME(20)
      NAMELIST/NSTAGE/U,   RL,NSL,SL,FCK,ADDC,COFL,COIL
      NAMELIST/NPLANE/H,RCSL,RCH,CLS,CRS,DESS,GNT,ANT,WGR,F1,D1,F2,D2,
     1VA,VE,WEM,WEN,T,NRCREW,NRENGN,NRSEAT,NPLANE,      NUSTAG
C
C      PARAMETER INITIALIZATION
C
       M=NAC
      NPLANE=1
C
C      MAIN PROGRAM CYCLE POINT FOR EACH AIRCRAFT - READ AND WRITE
C      INPUT LISTS
C
  909     K=0
      READ(5,NSTAGE)
      WRITE(6,NSTAGE)
    1 NUSTAG=0
      WRITE(6,512)
  512 FORMAT(*1*)
      READ(5,510) XNAME
  510 FORMAT(20A4)
      WRITE(6,511) XNAME
  511 FORMAT(5X,20A4)
      READ(5,NPLANE)
      WRITE(6,NPLANE)
      IF(NUSTAG.EQ.0) GO TO 2
      READ(5,NSTAGE)
      WRITE(6,NSTAGE)
C    DERIVATION OF THE ELEMENTS OF THE COST EQUATIONS
C    COEFFICIENTS IN THE FLIGHT CREW COSTS
    2  IF (NRCREW.GT.2.0) FCK=ADDC*(NRCREW-2.0)+FCK
C    VT-AIRCRAFT TOTAL COST, VA-AIRFRAME COST, VE-UNIT ENGINE COST
      VT=VA+VE*NRENGN
C    COEFFICIENTS IN THE MAINTENANCE LABOR COST EQUATIONS
C    WA-AIRFRAME WT, WEM-AIRCRAFT EMPTY WT, WEN-UNIT ENGINE WT
      WA=WEM-WEN*NRENGN
      FCAL=(WA*(5.0E-5)+6.0-630.0/(120.0+WA*1.0E-3))
      FHAL=0.59*FCAL
      FCEL=(0.3+T*3.0E-5)*NRENGN*0.5
      FHEL=(0.6+T*2.7E-5)*NRENGN*0.5
C    COEFFICIENTS IN MAINTENANCE MATERIAL COST EQUATIONS
      FCAM=VA*6.2*E-6*0.5
      FHAM=VA*3.08E-6*0.5
      FCEM=VE*NRENGN*2.0E-5
      FHEM=VE*NRENGN*2.5E-5
C    BLOCK SPEED COMPUTATION
C      CLIMB TIME-CLT  TO ALTITUDE-H
```

```
C     RATE OF CLIMB-SEA LEVEL=RCSL, RATE OF CLIMB-H=RCH
      CLT=2*H/((RCSL+RCH)*60.0)
C     DESCENT TIME - DEST
C     ASSUME THAT DESCENT TIME EQUALS CLIMB TIME
      DEST=CLT
C
C     CYCLE POINT FOR EACH STAGE UNDER STUDY (SOME STAGE LENGTH
C     DEPENDENT CALCULATIONS)
C
      DO 10 I=1,NSL
C     CRUISE TIME - CRT(I)
      CRT(I)=((SL(I)+0.015*SL(I))-(CLS*CLT+DESS*DEST))/CRS
      IF(SL(I).GT.1400.) CRT(I)=((SL(I)+0.02*SL(I)+20.0)-
     1(CLS*CLT+DESS*DEST))/CRS
C     GROUND MANEUVER TIME
C     AIR MANEUVER TIME
C     BLOCK TIME - BT(I)
      BT(I)=GMT+CLT+DEST+CRT(I)+AMT
C   BLOCK SPEED - BS(I)
      BS(I)=SL(I)/BT(I)
C   BLOCK FUEL COMPUTATION
C     F1,D1,F2,AND D2 ARE DATA POINTS ON THE RANGE-PAYLOAD DIAGRAMS
C     F1,D1 IS THE MAX. PAYLOAD POINT AND F2,D2 IS THE MAX. FUEL POINT
C   BLOCK FUEL - BF(I)
      BF(I)=WGR*0.01+((F1-F2)/(D2-D1))*SL(I)+0.033*((F1-F2)/(D2-D1))*CRS
      BF(1)=11200.
      BF(2)=19800.
      BF(3)=28000.
      BF(4)=34300.
C   FLIGHT TIME COMPUTATION
C   FLIGHT TIME - FLTT(I)
      FLTT(I)=BT(I)-GMT
C   CALCULATION OF THE OPERATING COSTS
C     FLYING OPERATIONS COSTS
C       FLIGHT CREW COSTS
      CFC(I)=(WGR*5.0E-5+FCK)/BS(I)
C       FUEL AND OIL COSTS
      CFO(I)=1.02*( COFL*BF(I)+NRENG*0.135* COIL*BT(I))/SL(I)
C       INSURANCE COSTS
      CI(I)=.001*VT/(U*BS(I))
C     TOTAL FLYING OPERATIONS COSTS
      CFOP(I)=CFC(I)+CFO(I)+CI(I)
C     DIRECT MAINTENANCE - FLIGHT EQUIPMENT COSTS
C       LABOR - AIRFRAME
      CLA(I)=RL*(FHAL*FLTT(I)+FCAL)/SL(I)
C       MATERIAL - AIRFRAME
      CMA(I)=(FHAM*FLTT(I)+FCAM)/SL(I)
C       LABOR - ENGINE
      CLE(I)=RL*(FHEL*FLTT(I)+FCEL)/SL(I)
C       MATERIAL - ENGINE
      CME(I)=(FHEM*FLTT(I)+FCEM)/SL(I)
C       MAINTENANCE BURDEN
      CMB(I)=1.8*(CLA(I)+CLE(I))
C     TOTAL DIRECT MAINTENANCE COSTS
      CM(I)=CLA(I)+CMA(I)+CLE(I)+CME(I)+CMB(I)
C     DEPRECIATION - FLIGHT EQUIPMENT
      CD(I)= 0.
```

```
      C   COST PER AIRCRAFT MILE                                        DIRECT   116
            CAM(I)=CFOP(I)+CM(I)+CD(I)                                  DIRECT   117
      C   COST PER FLIGHT HOUR                                          DIRECT   118
            CFH(I)=CAM(I)*BS(I)*BT(I)/FLTT(I)                           DIRECT   119
      C   COST PER BLOCK HOUR                                           DIRECT   120
            CBH(I)=CAM(I)*BS(I)                                         DIRECT   121
      C   DIRECT OPERATING COST PER AVAILABLE SEAT MILE                 DIRECT   122
            CASM(I)=CAM(I)/NRSEAT                                       DIRECT   123
       10   CONTINUE                                                    DIRECT   124
             WRITE (6,404)                                              DIRECT   125
       404   FORMAT (*-*,*$ PER AIRCRAFT MILE *)                        DIRECT   126
      C                                                                 DIRECT   127
      C     LOOP POINT TO WRITE DIRECT OPERATING COSTS PER BLOCK HOUR AFTER DIRECT 128
      C     COSTS PER AIRCRAFT MILE ARE WRITTEN                         DIRECT   129
      C                                                                 DIRECT   130
       505   WRITE (6,511) XNAME                                        DIRECT   131
            WRITE (6,97)  H                                             DIRECT   132
            WRITE (6,91) (SL(I),I=1,NSL)                                DIRECT   133
            WRITE (6,92) (BS(I),I=1,NSL)                                DIRECT   134
            WRITE (6,93) (BT(I),I=1,NSL)                                DIRECT   135
            WRITE (6,94) (FLTT(I),I=1,NSL)                              DIRECT   136
            WRITE (6,95) (CRT(I),I=1,NSL)                               DIRECT   137
            WRITE (6,96) (BF(I),I=1,NSL)                                DIRECT   138
            WRITE (6,100) U,   RL                                       DIRECT   139
            WRITE (6,101) (CFC(I),I=1,NSL)                              DIRECT   140
            WRITE (6,102) (CFO(I),I=1,NSL)                              DIRECT   141
            WRITE (6,103) (CI(I),I=1,NSL)                               DIRECT   142
            WRITE (6,104) (CFOP(I),I=1,NSL)                             DIRECT   143
            WRITE (6,105) (CLA(I),I=1,NSL)                              DIRECT   144
            WRITE (6,106) (CMA(I),I=1,NSL)                              DIRECT   145
            WRITE (6,107) (CLE(I),I=1,NSL)                              DIRECT   146
            WRITE (6,108) (CME(I),I=1,NSL)                              DIRECT   147
            WRITE (6,109) (CMB(I),I=1,NSL)                              DIRECT   148
            WRITE (6,110) (CM(I),I=1,NSL)                               DIRECT   149
      C                                                                 DIRECT   150
      C     SKIP REST OF WRITE STATEMENTS WHEN WRITING COSTS PER BLOCK HOUR DIRECT 151
      C                                                                 DIRECT   152
               IF(K-1)212,214,214                                       DIRECT   153
       212  WRITE (6,112) (CAM(I),I=1,NSL)                              DIRECT   154
            WRITE (6,113) (CFH(I),I=1,NSL)                              DIRECT   155
            WRITE (6,114) (CBH(I),I=1,NSL)                              DIRECT   156
            WRITE (6,115) (CASM(I),I=1,NSL)                             DIRECT   157
         91 FORMAT(*-*,*STAGE LENGTH (MILES)        *,13F8.0)           DIRECT   158
         92 FORMAT(*-*,*BLOCK SPEED (MPH)           *,13F8.0)           DIRECT   159
         93 FORMAT(* BLOCK TIME (HOURS)          *,10F8.3)              DIRECT   160
         94 FORMAT(* FLIGHT TIME (HOURS)         *,10F8.3)              DIRECT   161
         95 FORMAT(* CRUISE TIME (HOURS)         *,10F8.3)              DIRECT   162
         96 FORMAT(* BLOCK FUEL (POUNDS)         *,10F8.0)              DIRECT   163
         97 FORMAT(*-*,*CRUISE ALTITUDE (FEET)      *,10F8.0)           DIRECT   164
        100 FORMAT(*0*,*D.O.C. FACTORS (INPUT) - ANN UTILIZATION(HR)=*, DIRECT   165
           1F6.0,*  LABOR RATE($/HR)=*,F5.2)                            DIRECT   166
        101 FORMAT(*0*,* DIRECT OPERATING COSTS*/*0*,* FLYING OPERATIONS COSTS DIRECT 167
           1*/* FLIGHT CREW               *,10F8.3)                     DIRECT   168
        102 FORMAT(* FUEL AND OIL            *,10F8.3)                  DIRECT   169
        103 FORMAT(* HULL INSURANCE          *,10F8.3)                  DIRECT   170
        104 FORMAT(* TOTAL FLIGHT OPS        *,10F8.3)                  DIRECT   171
        105 FORMAT(*0*,* DIRECT MAINTENANCE COSTS*/* LABOR AIRFRAME     DIRECT   172
```

```
     1  *,10F8.3)
  106 FORMAT(* MATERIAL AIRFRAME          *,10F8.3)
  107 FORMAT(* LABOR ENGINES              *,10F8.3)
  108 FORMAT(* MATERIAL ENGINES           *,10F8.3)
  109 FORMAT(* MAINT. BURDEN              *,10F8.3)
  110 FORMAT(* TOTAL MAINTENANCE          *,10F8.3)
  112 FORMAT(*0*,* TOTAL DIRECT OPERATING COST*/*0*,
     1*$/AIRCRAFT MILE           *,10F8.3)
  113 FORMAT(* $/FLIGHT HOUR              *,10F8.4)
  114 FORMAT(* $/BLOCK HOUR               *,10F8.1)
  115 FORMAT(* $/AVAIL. SEAT MILE         *,10F8.3)
C   COST PER CRUISE MILE FOR THE AIRCRAFT
      CACM=(CAM(2)*SL(2)-CAM(1)*SL(1))/(SL(2)-SL(1))
C   COST PER TAKEOFF FOR THE AIRCRAFT
      CTO=(CAM(1)-CACM)*SL(1)
C   COST PER CRUISE MILE PER SEAT
      CSCM=CACM/NRSEAT
C   COST PER TAKEOFF PER SEAT
      CSTO=CTO/NRSEAT
      WRITE (6,116) CTO,CACM
      WRITE (6,117) CSTO,CSCM
 116  FORMAT (*0*,* COST PER AIRCRAFT TRIP = $*,F7.2,* PLUS $*,F6.2,
     1*/MILE*)
 117  FORMAT (*0*,* COST PER SEAT TRIP = $*,F5.2,* PLUS $*,F6.4,*/MILE*)
C   CALCULATION OF THE OPERATING COSTS PER BLOCK HOUR
          K=1
C
C     SECOND CYCLE FOR STAGE LENGTH DEPENDENT CALCULATIONS
C
C     FLYING OPERATIONS COSTS
C       FLIGHT CREW COSTS
        DO  500 I=1,NSL
      CFC(I)=(WGR*5.0E-5+FCK)
C       FUEL AND OIL COSTS
      CFO(I)=(1.02*( COFL*BF(I)+NRENGH*0.135* COIL*BT(I))/SL(I))*BS(I)
C       INSURANCE COSTS
      CI(I)=.001*VT/ U
C     TOTAL FLYING OPERATIONS COSTS
      CFOP(I)=CFC(I)+CFO(I)+CI(I)
C     DIRECT MAINTENANCE - FLIGHT EQUIPMENT COSTS
C       LABOR - AIRFRAME
      CLA(I)=(RL*(FHAL*FLTT(I)+FCAL)/SL(I))*BS(I)
C       MATERIAL - AIRFRAME
      CMA(I)=((FHAM*FLTT(I)+FCAM)/SL(I))*BS(I)
C       LABOR - ENGINE
      CLE(I)=(RL*(FHEL*FLTT(I)+FCEL)/SL(I) )*BS(I)
C       MATERIAL - ENGINE
      CME(I)=((FHEM*FLTT(I)+FCEM)/SL(I) )*BS(I)
C       MAINTENANCE BURDEN
      CMB(I)=1.8*(CLA(I)+CLE(I))
C     TOTAL DIRECT MAIN ENANCE COSTS
      CM(I)=CLA(I)+CMA(I)+CLE(I)+CME(I)+CMB(I)
C     FIRST STAGE LENGTH SHOULD BE FROM RED BOOK
      DOC1(NPLANE)=(CM(1)+CFOP(1))*U
  500   CONTINUE
       WRITE (6,303)
  303  FORMAT (*-*,*$ PER BLOCK HOUR *)
```

```
      C
      C     TRANSFER TO WRITE COSTS PER BL3CK HOUR
      C
             GO TO 505
        214  MPLANE=MPLANE+1
        213 IF(MPLANE.GT.M)    GO T3 23
      C
      C     TRANSFER UNTIL ALL AIRCRAFT HAVE BEEN PROCESSED
      C
            GO TO 909
        20  RETURN
            END
```

```
      SUBROUTINE INDIR(IOC1,NAC)                                        INDIR     2
      DIMENSION IOC1(100)                                               INDIR     3
C   THIS IS THE IOC PROGRAM FOR AMES STUDY  (1976)                      INDIR     4
C                                                                       INDIR     5
C     INPUT BASIC INDIRECT COST PARAMETERS, THEN CALCULATE BASIC        INDIR     6
C     INDIRECT OPERATING COSTS PER AIRCRAFT                             INDIR     7
C                                                                       INDIR     8
      DIMENSION DIS(17),TB(17),SB(17),CF(17),DPT(17),SL(17),C6(17),     INDIR     9
     1 C7(17),C8(17),C9(17),C10(17),C11(17),C12(17),C13(17),C14(17),    INDIR    10
     2 C15(17), C16(17),C17(17),C18(17),C19(17),C20(17),C21(17),        INDIR    11
     3C22(17),C23(17),TTS(17),TRS(17),C24(17),C25(17),C26(17),          INDIR    12
     4C27(17),TAP(17),C28(17),C29(17),C30(17),C31(17),C32(17),          INDIR    13
     5C33(17),C34(17),C35(17),C1(17),C2(17),C4(17),C36(17),FLTT(17),    INDIR    14
     6CAM(17),CFM(17),CBM(17),CASM(17),FLF(17),CLF(17),CRT(17)          INDIR    15
      DIMENSION XNAME(20),TAS(17)                                       INDIR    16
      NAMELIST/NPLANE/M,RCSL,RCH,CLS,CRS,DESS,GMT,AMT,NRSEAT            INDIR    17
      NAMELIST/NSTAGE/MSL,FLF,CLF,DIS,CF,DPT,U                          INDIR    18
      NAMELIST/STEWS/AI5,FSTEW,CSTEW                                    INDIR    19
      NAMELIST/FOOD/AI6,FS,CS,FOODR                                     INDIR    20
      NAMELIST/PAXFLT/AI7                                               INDIR    21
      NAMELIST/ACSERV/ AI8,AI9,AI10                                     INDIR    22
      NAMELIST/TRAFF/AI11,AI12,AI12A,BAG,RTM,RTP                        INDIR    23
      NAMELIST/RES/AI13,AI14,AI15,EXP                                   INDIR    24
      NAMELIST/ADV/ AI16,AI17                                           INDIR    25
      NAMELIST/MAINT/AI18,AI19,AI20,AI2                                 INDIR    26
      NAMELIST/GENADM/AI21,AI1,AI2,AI4                                  INDIR    27
C                                                                       INDIR    28
C     PROGRAM INITIALIZATION                                            INDIR    29
C                                                                       INDIR    30
       M=NAC                                                            INDIR    31
      NPLANE=1                                                          INDIR    32
C                                                                       INDIR    33
C     MAIN PROGRAM CYCLE POINT FOR EACH AIRCRAFT - READ AND WRITE       INDIR    34
C     INPUT LISTS                                                       INDIR    35
C                                                                       INDIR    36
  1   NUSTAG=0                                                          INDIR    37
      WRITE(6,512)                                                      INDIR    38
  512 FORMAT('1')                                                       INDIR    39
      READ(5,510) XNAME                                                 INDIR    40
  510 FORMAT(20A4)                                                      INDIR    41
      WRITE(6,511) XNAME                                                INDIR    42
  511 FORMAT(5X,20A4)                                                   INDIR    43
      READ(5,NPLANE)                                                    INDIR    44
      WRITE(6,NPLANE)                                                   INDIR    45
      READ(5,NSTAGE)                                                    INDIR    46
      WRITE(6,NSTAGE)                                                   INDIR    47
      READ(5,STEWS)                                                     INDIR    48
      WRITE(6,STEWS)                                                    INDIR    49
      READ(5,FOOD)                                                      INDIR    50
      WRITE(6,FOOD)                                                     INDIR    51
      READ(5,PAXFLT)                                                    INDIR    52
      WRITE(6,PAXFLT)                                                   INDIR    53
      READ(5,ACSERV)                                                    INDIR    54
      WRITE(6,ACSERV)                                                   INDIR    55
      READ(5,TRAFF)                                                     INDIR    56
      WRITE(6,TRAFF)                                                    INDIR    57
      READ(5,RES)                                                       INDIR    58
```

```
      WRITE(6,RES)                                                  INDIR    59
      READ(5,ADV)                                                   INDIR    60
      WRITE(6,ADV)                                                  INDIR    61
      READ(5,MAINT)                                                 INDIR    62
      WRITE(6,MAINT)                                                INDIR    63
      READ(5,GENADM)                                                INDIR    64
      WRITE(6,GENADM)                                               INDIR    65
C   BLOCK TIME  COMPUTATION  TB(I)                                  INDIR    66
C     CLIMB TIME-CLT  TO ALTITUDE-H                                 INDIR    67
C     RATE OF CLIMB-SEA LEVEL=RCSL, RATE OF CLIMB-H=RCH             INDIR    68
      CLT=2*H/((RCSL+RCH)*60.0)                                     INDIR    69
C     DESCENT TIME - DEST                                           INDIR    70
C     ASSUME THAT DESCENT TIME EQUALS CLIMB TIME                    INDIR    71
      DEST=CLT                                                      INDIR    72
C                                                                   INDIR    73
C     CYCLE POINT FOR EACH STAGE UNDER STUDY (SOME STAGE LENGTH     INDIR    74
C     DEPENDENT CALCULATIONS)                                       INDIR    75
C                                                                   INDIR    76
      DO 10 I=1,NSL                                                 INDIR    77
       SL(I)=DIS(I)                                                 INDIR    78
C     CRUISE TIME - CRT(I)                                          INDIR    79
      CRT(I)=((SL(I)+0.015*SL(I))-(CLS*CLT+DESS*DEST))/CRS          INDIR    80
      IF(SL(I).GT.1400.) CRT(I)=((SL(I)+0.02*SL(I)+20.0)-           INDIR    81
     1(CLS*CLT+DESS*DEST))/CRS                                      INDIR    82
C     GROUND MANEUVER TIME                                          INDIR    83
      GMT=0.16                                                      INDIR    84
C     AIR MANEUVER TIME                                             INDIR    85
      AMT=0.16                                                      INDIR    86
C     BLOCK TIME - TB(I)                                            INDIR    87
      TB(I)=GMT+CLT+DEST+CRT(I)+AMT                                 INDIR    88
C   BLOCK SPEED - SB(I)                                             INDIR    89
      SB(I)=SL(I)/TB(I)                                             INDIR    90
C   FLIGHT TIME COMPUTATION                                         INDIR    91
C   FLIGHT TIME - FLTT(I)                                           INDIR    92
      FLTT(I)=TB(I)-GMT                                             INDIR    93
C   DERIVATION OF THE ELEMENTS OF THE IOC  EQUATION                 INDIR    94
C     STEWARDESS EXPENSE FIRST CLASS                                INDIR    95
       C6(I)= AI5*FSTEW*TB(I)                                       INDIR    96
C     STEWARDESS EXPENSE COACH                                      INDIR    97
       C7(I)= AI5*CSTEW*TB(I)                                       INDIR    98
C     TOTAL STEWARDESS EXPENSE                                      INDIR    99
       C8(I)= C6(I)+C7(I)                                           INDIR   100
C     FOOD EXPENSE FIRST CLASS                                      INDIR   101
       C9(I)=AI6*FS*FLF(I)*FOODR*TB(I)                              INDIR   102
C     FOOD EXPENSE COACH                                            INDIR   103
       C10(I)=AI6*CS*CLF(I)*TB(I)                                   INDIR   104
C     TOTAL FOOD EXPENSE                                            INDIR   105
       C11(I)= C9(I)+C10(I)                                         INDIR   106
C     OTHER PASSENGER IN FLT EXPENSE FIRST CLASS                    INDIR   107
       C12(I)= AI7*FS*FLF(I)*DIS(I)*CF(I)                           INDIR   108
C     OTHER PASSENGER IN FLT EXPENSE COACH                          INDIR   109
       C13(I)=AI7*CS*CLF(I)*DIS(I)*CF(I)                            INDIR   110
C     TOTAL OTHER PASSENGER IN FLT EXPENSE                          INDIR   111
       C14(I)=C12(I)+C13(I)                                         INDIR   112
C     AIRCRAFT SERVICING EXPENSE , LINE SERVICING                   INDIR   113
       C15(I)=AI8*DPT(I)                                            INDIR   114
C     AIRCRAFT SERVICING EXPENSE , CONTROL                          INDIR   115
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         C16(I)=AI9*TB(I)                                                  INDIR     116
      C  AIRCRAFT SERVICING EXPENSE, LANDING FEES                          INDIR     117
         C17(I)= AI10*DPT(I)                                               INDIR     118
      C  TOTAL AIRCRAFT SERVICING-TAS                                      INDIR     119
         TAS(I)=C15(I)+C16(I)+C17(I)                                       INDIR     120
      C  TRAFFIC SERVICING EXPENSE PASSENGER FIRST CLASS                   INDIR     121
         C18(I)=AI11*FS*FLF(I)                                             INDIR     122
      C  TRAFFIC SERVICING EXPENSE PASSENGER COACH                         INDIR     123
         C19(I)=AI11*CS*CLF(I)                                             INDIR     124
      C  TRAFFIC SERVICING EXPENSE BAGGAGE FIRST CLASS                     INDIR     125
         C20(I)=AI12*(BAG/2000)*FS*FLF(I)                                  INDIR     126
      C  TRAFFIC SERVICING EXPENSE BAGGAGE COACH                           INDIR     127
         C21(I)=AI12*(BAG/2000)*CS*CLF(I)                                  INDIR     128
      C  TRAFFIC SERVICING EXPENSE PAX - BAGGAGE                           INDIR     129
         C22(I)=C18(I)+C19(I)+C20(I)+C21(I)                                INDIR     130
      C  TRAFFIC SERVICING EXPENSE CARGO                                   INDIR     131
         C23(I)=AI12A*(RTM+RTP)                                            INDIR     132
      C  TOTAL TRAFFIC SERVICING-TTS                                       INDIR     133
         TTS(I)=C22(I)+C23(I)                                              INDIR     134
      C  RESERVATION AND SALES EXPENSE FIRST CLASS                         INDIR     135
         C24(I)=AI13*FS*FLF(I)+AI14*FS*FLF(I)*DIS(I)*CF(I)                 INDIR     136
      C  RESERVATION AND SALES EXPENSE COACH                               INDIR     137
         C25(I)=AI13*CS*CLF(I)+AI14*CS*CLF(I)*DIS(I)*CF(I)                 INDIR     138
      C  RESERVATION AND SALES EXPENSE PAX TOTAL                           INDIR     139
         C26(I)=C24(I)+C25(I)                                              INDIR     140
      C  EXPRESS TONS ENPLANED                                             INDIR     141
         RTE=RTP*EXP                                                       INDIR     142
      C  FREIGHT TONS ENPLANED                                             INDIR     143
         RTF=RTP-RTE                                                       INDIR     144
      C  RESERVATION AND SALES EXPENSE , PROPERTY                          INDIR     145
         C27(I)=(RTF+RTE)*AI15*DIS(I)*CF(I)                                INDIR     146
      C  RESERVATION AND SALES EXPENSE , TOTAL-TRS                         INDIR     147
         TRS(I)=C26(I)+C27(I)                                              INDIR     148
      C  ADVERTISING - PUBLICITY EXPENSE FIRST CLASS                       INDIR     149
         C28(I)=AI16*FS*FLF(I)*DIS(I)*CF(I)                                INDIR     150
      C  ADVERTISING - PUBLICITY EXPENSE COACH                             INDIR     151
         C29(I)=AI16*CS*CLF(I)*DIS(I)*CF(I)                                INDIR     152
      C  ADVERTISING - PUBLICITY EXPENSE PAX TOTAL                         INDIR     153
         C30(I)=C28(I)+C29(I)                                              INDIR     154
      C  ADVERTISING - PUBLICITY EXPENSE PROPERTY                          INDIR     155
         C31(I)=(RTF+RTE)*AI17*DIS(I)*CF(I)                                INDIR     156
      C  ADVERTISING - PUBLICITY EXPENSE TOTAL- TAP(I)                     INDIR     157
         TAP(I)=C30(I)+C31(I)                                              INDIR     158
      C  MAINTENANCE EXPENSE GROUND PROPERY - EQUIPMENT                    INDIR     159
         C32(I)=AI18*DPT(I)                                                INDIR     160
      C  DEPR. GENERAL GRD. PROP. - EQUIP. AND AMORT. EXCL. DIRECTLY ASSO. INDIR     161
         C33(I)=AI19*DPT(I)                                                INDIR     162
      C  DEPR. MAINTENANCE EQUIP.                                          INDIR     163
         C2(I)=AI2*TB(I)                                                   INDIR     164
         C34(I)=AI20*(C2(I)+C32(I))                                        INDIR     165
      C  GENERAL AND ADMINISTRATIVE EXPENSE                                INDIR     166
         C1(I)=AI1*TB(I)                                                   INDIR     167
         C4(I)=AI4*TB(I)                                                   INDIR     168
         C35(I)=AI21*(C1(I)+C2(I)+C4(I)+C8(I)+C11(I)+C14(I)+C15(I)+        INDIR     169
        1C16(I)+C17(I)+C22(I)+C23(I)+C25(I)+C27(I)+C30(I)+C31(I)+C32(I))   INDIR     170
      C  TOTAL INDIRECT EXPENSE                                            INDIR     171
         C36(I)=C8(I)+C11(I)+C14(I)+C15(I)+C16(I)+C17(I)+C22(I)+C23(I)+    INDIR     172
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      1 C26(I)+C27(I)+C30(I)+C31(I)+C32(I)+C33(I)+C34(I)+C35(I)           INDIR   173
C     FIRST STAGE LENGTH SHOULD BE FROM RED BOOK                          INDIR   174
      IOC1(MPLANE)=C36(1)*U/TB(1)                                         INDIR   175
C     INDIRECT COST PER AIRCRAFT MILE                                     INDIR   176
       CAM(I)=C36(I)/SL(I)                                                INDIR   177
C     INDIRECT COST PER FLIGHT HOUR                                       INDIR   178
       CFH(I)=C36(I)/FLTT(I)                                              INDIR   179
C     INDIRECT COST PER BLOCK HOUR                                        INDIR   180
       CBH(I)=C36(I)/TB(I)                                                INDIR   181
C     INDIRECT COST PER AVAILABLE SEAT MILE                               INDIR   182
       CASM(I)=CAM(I)/NRSEAT                                              INDIR   183
   10  CONTINUE                                                           INDIR   184
C                                                                         INDIR   185
C     WRITE OUTPUT TABLE OF INDIRECT OPERATING COSTS PER BLOCK HOUR       INDIR   186
C     FOR EACH STAGE FOR EACH AIRCRAFT                                    INDIR   187
C                                                                         INDIR   188
      WRITE(6,512)                                                        INDIR   189
      WRITE(6,511) XNAME                                                  INDIR   190
      WRITE (6,91) (SL(I),I=1,NSL)                                        INDIR   191
      WRITE (6,92) (SB(I),I=1,NSL)                                        INDIR   192
      WRITE (6,93) (TB(I),I=1,NSL)                                        INDIR   193
      WRITE (6,94) (FLTT(I),I=1,NSL)                                      INDIR   194
      WRITE (6,95) (DPT(I),I=1,NSL)                                       INDIR   195
      WRITE (6,96) (CF(I),I=1,NSL)                                        INDIR   196
      WRITE (6,97) (CLF(I),I=1,NSL)                                       INDIR   197
      WRITE (6,100)(FLF(I),I=1,NSL)                                       INDIR   198
      WRITE (6,101) (C1 (I),I=1,NSL)                                      INDIR   199
      WRITE (6,102) (C2 (I),I=1,NSL)                                      INDIR   200
      WRITE (6,104) (C4  (I),I=1,NSL)                                     INDIR   201
      WRITE (6,106) (C8 (I),I=1,NSL)                                      INDIR   202
      WRITE (6,107) (C11(I),I=1,NSL)                                      INDIR   203
      WRITE (6,108) (C14(I),I=1,NSL)                                      INDIR   204
      WRITE (6,109) (C15(I),I=1,NSL)                                      INDIR   205
      WRITE (6,110) (C16(I),I=1,NSL)                                      INDIR   206
      WRITE (6,111) (C17(I),I=1,NSL)                                      INDIR   207
      WRITE (6,211) (TAS(I),I=1,NSL)                                      INDIR   208
      WRITE (6,112) (C22(I),I=1,NSL)                                      INDIR   209
      WRITE (6,113) (C23(I),I=1,NSL)                                      INDIR   210
      WRITE (6,212) (TTS(I),I=1,NSL)                                      INDIR   211
      WRITE (6,114) (C26(I),I=1,NSL)                                      INDIR   212
      WRITE (6,115) (C27 (I),I=1,NSL)                                     INDIR   213
      WRITE (6,216) (TRS (I),I=1,NSL)                                     INDIR   214
      WRITE (6,116) (C30 (I),I=1,NSL)                                     INDIR   215
      WRITE (6,117) (C31 (I),I=1,NSL)                                     INDIR   216
      WRITE (6,217) (TAP (I),I=1,NSL)                                     INDIR   217
      WRITE (6,118) (C32 (I),I=1,NSL)                                     INDIR   218
      WRITE (6,119) (C33 (I),I=1,NSL)                                     INDIR   219
      WRITE (6,120) (C34 (I),I=1,NSL)                                     INDIR   220
      WRITE (6,121) (C35 (I),I=1,NSL)                                     INDIR   221
      WRITE (6,122) (C36 (I),I=1,NSL)                                     INDIR   222
      WRITE (6,123) (CAM (I),I=1,NSL)                                     INDIR   223
      WRITE (6,124) (CFH (I),I=1,NSL)                                     INDIR   224
      WRITE (6,125) (CBH (I),I=1,NSL)                                     INDIR   225
      WRITE (6,126) (CASM(I),I=1,NSL)                                     INDIR   226
   91 FORMAT(*-     PASSENGER TRIP DISTANCE(MILES)        *,10F8.0)       INDIR   227
   92 FORMAT(*-    BLOCK SPEED (MPH)                      *,10F8.0)       INDIR   228
   93 FORMAT(* BLOCK TIME (HOURS)                         *,10F8.3)       INDIR   229
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      94 FORMAT(* FLIGHT TIME (HOURS)                      *,10F8.3)   INDIR
      95 FORMAT(* DEP/PAX TRIP (FLIGHT BASIS)              *,10F8.3)   INDIR
      96 FORMAT(* PASSENGER TRIP CIRCUITRY FACTOR          *,10F8.3)   INDIR
      97 FORMAT(* COACH LOAD FACTOR                        *,10F8.3)   INDIR
     100 FORMAT(* FIRST CLASS LOAD FACTOR                  *,10F8.3)   INDIR
     101 FORMAT(* FLYING OPERATIONS(LESS RENTALS) EXP   C1 *,10F8.3)   INDIR
     102 FORMAT(* MAINTENANCE EXPENSE FLY EQUIPMENT     C2 *,10F8.3)   INDIR
     104 FORMAT(* RENTALS FLT EQUIP                     C4 *,10F8.3)   INDIR
     106 FORMAT(*0*,*PASSENGER IN FLY EXPENSE*/                        INDIR
        1         * STEWS                               C8 *,10F8.3)   INDIR
     107 FORMAT(* FOOD                                  C11 *,10F8.3)  INDIR
     108 FORMAT(* OTHER                                 C14 *,10F8.3)  INDIR
     109 FORMAT(*0*,*AIRCRAFT SERVICING EXP */                         INDIR
        1         * LINE SERVICE                        C15 *,10F8.3)  INDIR
     110 FORMAT(* CONTROL                               C16 *,10F8.3)  INDIR
     111 FORMAT(* LANDING FEES                          C17 *,10F8.3)  INDIR
     211 FORMAT(* TOTAL AIRCRAFT SERVICING              TAS *,10F8.3)  INDIR
     112 FORMAT(*0*,*TRAFFIC SERVICING EXP */                          INDIR
        1         * PAX - BAGGAGE                       C22 *,10F8.3)  INDIR
     113 FORMAT(* CARGO                                 C23 *,10F8.3)  INDIR
     212 FORMAT(* TOTAL TRAFFIC SERVICING               TTS *,10F8.3)  INDIR
     114 FORMAT(*0*,*RESERVATION - SALES     */                        INDIR
        1         * PAX                                 C26 *,10F8.3)  INDIR
     115 FORMAT(* PROPERTY                              C27 *,10F8.3)  INDIR
     216 FORMAT(* TOTAL RESERVATION - SALES             TRS *,10F8.3)  INDIR
     116 FORMAT(*0*,*ADVERTISING - PUBLICITY */                        INDIR
        1         * PAX                                 C30 *,10F8.3)  INDIR
     117 FORMAT(* PROPERTY                              C31 *,10F8.3)  INDIR
     217 FORMAT(* TOTAL ADVERTISING - PUBLICITY         TAP *,10F8.3)  INDIR
     118 FORMAT(* MAINTENANCE EXP- GRD PROP - EQUIP     C32 *,10F8.3)  INDIR
     119 FORMAT(* DEPR-GENERAL GRD PROP - EQUIP - AMORT C33 *,10F8.3)  INDIR
     120 FORMAT(* DEPR-MAINTENANCE EQUIP                C34 *,10F8.3)  INDIR
     121 FORMAT(* GENERAL - ADM EXPENSE                 C35 *,10F8.3)  INDIR
     122 FORMAT(* TOTAL INDIRECT OPERATING EXPENSE      C36 *,10F8.3)  INDIR
     123 FORMAT(* INDIRECT COST PER AIRCRAFT MILE          *,10F8.3)   INDIR
     124 FORMAT(* INDIRECT COST PER FLIGHT HOUR            *,10F8.0)   INDIR
     125 FORMAT(* INDIRECT COST PER BLOCK HOUR             *,10F8.3)   INDIR
     126 FORMAT(* INDIRECT COST PER AV. SEAT MILES         *,10F8.3)   INDIR
C     COST PER CRUISE MILE FOR THE AIRCRAFT                            INDIR
        CACM=(CAN(2)*SL(2)-CAN(1)*SL(1))/(SL(2)-SL(1))                 INDIR
C     COST PER TAKEOFF FOR THE AIRCRAFT                                INDIR
        CTO=(CAN(1)-CACM)*SL(1)                                        INDIR
C     COST PER CRUISE MILE PER SEAT                                    INDIR
        CSCM=CACM/NRSEAT                                               INDIR
C     COST PER TAKEOFF PER SEAT                                        INDIR
        CSTO=CTO/NRSEAT                                                INDIR
        WRITE (6,316) CTO,CACM                                         INDIR
        WRITE (6,317) CSTO,CSCM                                        INDIR
  316   FORMAT (*0*,* COST PER AIRCRAFT TRIP = $*,F7.2,* PLUS $*,F6.2, INDIR
       1*/MILE*)                                                       INDIR
  317   FORMAT (*0*,* COST PER SEAT TRIP = $*,F5.2,* PLUS $*,F6.4,*/MILE*) INDIR
  214    NPLANE=NPLANE+1                                               INDIR
         IF(NPLANE.GT.N)    GO TO 20                                   INDIR
C                                                                      INDIR
C       CYCLE UNTIL ALL AIRCRAFT HAVE BEEN PROCESSED                   INDIR
C                                                                      INDIR
         GO TO 1                                                       INDIR
```

```
   20    RETURN
         END                                                 INDIR     287
                                                             INDIR     288
```

```
      SUBROUTINE REPAY
C
C     CALCULATE REPAYMENT SCHEDULE FOR EACH AIRCRAFT
C
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25),YRPPAY(25,100)
      LEVEL 2,
     X     AREV,    CF,      CSAREV,  CSCF,    CSDCF,   CSDEPR,
     1CSEBIT,  CSEBT,   CSINTI,  CSINTX,  CSNTRN,  CSOPCT,  CSPRIN,
     2CSYNTR,  DCF,     DEPR,    DEPREC,  EBIAT,   EBT,     ECLIFE,
     3I,       INCTAX,  INTINV,  IYEAR,   NAC,     NTEARN,  OPCOST,
     4PRIN,    PV,      R,       SALVAG,  SAREV,   SDEPR,   SEBIAT,
     5SEBT,    SINCTX,  SINTIN,  SNTERN,  SOPCST,  SPRIN,   SSALVG,
     6SSTDEP,  STDEP,   SYNTRS,  YNTRST,
     7COST,    PRICE,   RES,     RRATE,   TXRATE,
     8BVALUE
      LEVEL 2, YRPPAY
      COMMON/IN/AREV,   CF,      CSAREV,  CSCF,    CSDCF,   CSDEPR,
     1CSEBIT,  CSEBT,   CSINTI,  CSINTX,  CSNTRN,  CSOPCT,  CSPRIN,
     2CSYNTR,  DCF,     DEPR,    DEPREC,  EBIAT,   EBT,     ECLIFE,
     3I,       INCTAX,  INTINV,  IYEAR,   NAC,     NTEARN,  OPCOST,
     4PRIN,    PV,      R,       SALVAG,  SAREV,   SDEPR,   SEBIAT,
     5SEBT,    SINCTX,  SINTIN,  SNTERN,  SOPCST,  SPRIN,   SSALVG,
     6SSTDEP,  STDEP,   SYNTRS,  YNTRST,
     7COST,    PRICE,   RES,     RRATE,   TXRATE,
     8BVALUE
      COMMON/YRPPAY/YRPPAY
      REAL INTINV,INCTAX,NTEARN
C
C     MAIN LOOP POINT FOR EACH AIRCRAFT - SKIP PROCESSING WITHIN LOOP
C     EXCEPT FOR FIRST YEAR CRAFT IS PURCHASED
C
      DO 90 J=1,NAC
      IF (COST(I,J) .LE.0.0) GO TO 90
      PBCOST=COST(I,J)
C
C     CALCULATE TOTAL ANNUAL PAYMENTS (PRINCIPAL PLUS INTEREST)
C
      YRPPAY(I,J)=(PBCOST*RRATE(J))*((1+RRATE(J))**ECLIFE(J))/
     1(((1+RRATE(J))**ECLIFE(J))-1)
      NLIFE=ECLIFE(J)
      NN=1+NLIFE-1
      DO 50 N=1,NN
C
C     CALCULATE INTEREST AND PRINCIPAL PAYMENT SCHEDULE
C
      YNTRST(N,J) = PBCOST*RRATE(J)
      PRIN(N,J) = YRPPAY(I,J) - YNTRST(N,J)
      PBCOST=PBCOST-PRIN(N,J)
```

```
      50 CONTINUE                                               REPAY      59
C                                                               REPAY      60
C        END OF MAIN PROGRAM LOOP                               REPAY      61
C                                                               REPAY      62
      90 CONTINUE                                               REPAY      63
         RETURN                                                 REPAY      64
         END                                                    REPAY      65
```

```
      SUBROUTINE DEPSUB
C
C     CALCULATE DEPRECIATION SCHEDULE FOR EACH AIRCRAFT - DOUBLE
C     DECLINING BALANCE METHOD FOR FIRST HALF OF ECONOMIC LIFE AND
C     STRAIGHT LINE METHOD FOR BALANCE OF ECONOMIC LIFE
C
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25)
      LEVEL 2,
     X           AREV,      CF,        CSAREV,    CSCF,      CSDCF,     CSDEPR,
     1CSEBIT,    CSEBT,     CSINTI,    CSINTX,    CSNTRN,    CSOPCT,    CSPRIN,
     2CSYNTR,    DCF,       DEPR,      DEPREC,    EBIAT,     EBT,       ECLIFE,
     3I,         INCTAX,    INTINV,    IYEAR,     NAC,       NTEARN,    OPCOST,
     4PRIN,      PV,        R,         SALVAG,    SAREV,     SDEPR,     SEBIAT,
     5SEBT,      SINCTX,    SINTIN,    SNTERN,    SOPCST,    SPRIN,     SSALVG,
     6SSTDEP,    STDEP,     SYNTRS,    YNTRST,
     7COST,      PRICE,     RES,       RRATE,     TXRATE,
     8BVALUE
      COMMON/IN/AREV,       CF,        CSAREV,    CSCF,      CSDCF,     CSDEPR,
     1CSEBIT,    CSEBT,     CSINTI,    CSINTX,    CSNTRN,    CSOPCT,    CSPRIN,
     2CSYNTR,    DCF,       DEPR,      DEPREC,    EBIAT,     EBT,       ECLIFE,
     3I,         INCTAX,    INTINV,    IYEAR,     NAC,       NTEARN,    OPCOST,
     4PRIN,      PV,        R,         SALVAG,    SAREV,     SDEPR,     SEBIAT,
     5SEBT,      SINCTX,    SINTIN,    SNTERN,    SOPCST,    SPRIN,     SSALVG,
     6SSTDEP,    STDEP,     SYNTRS,    YNTRST,
     7COST,      PRICE,     RES,       RRATE,     TXRATE,
     8BVALUE
      REAL INTINV,INCTAX,NTEARN
C
C     MAIN LOOP POINT FOR EACH AIRCRAFT - DO DOUBLE DECLINING BALANCE
C     METHOD COMPUTATIONS FIRST
C
      DO 92 J=1,NAC
      RATE = 2. * (1.-RES(J))/ECLIFE(J)
      IECLIF=ECLIFE(J)/2.
      BVALUE(1,J) = PRICE(I,J)
      IF(PRICE(I,J) .LE.0.0) GO TO 92
      MM=ECLIFE(J)
      DO 20 K=1,MM
      II=K
      DEPR(II,J)=BVALUE(II,J)*RATE
      BVALUE(II+1,J)=BVALUE(II,J)-DEPR(II,J)
      LL=IECLIF+1
      DO 30 M=LL,MM
      DEPR(M,J)=0.0
   30 CONTINUE
   20 CONTINUE
C
C     PERFORM STRAIGHT LINE METHOD CALCULATIONS
```

```
      C
            STLIFE=ECLIFE(J)-IECLIF
      C     ASSUME SALVAGE VALUE SAME AS FOR NLIFE
            M=ECLIFE(J)-1
            DO 75 L=1,M
            SALVAG(L,J)=0.0
        75  CONTINUE
            NLIFE=ECLIFE(J)
            SALVAG(NLIFE,J)=PRICE(1,J)*RES(J)
            II=IECLIF+1
            DO 55 N=II,NLIFE
            STDEP(N,J)=(BVALUE(II,J)-SALVAG(NLIFE,J))/STLIFE
            M=N+1
            BVALUE(M,J)=BVALUE(N,J)-STDEP(N,J)
         55 CONTINUE
      C     ASSUME STRAIGHT LINE DEPRECIATION IS ZERO UPTO II YEARS
            DO 65 N=1,IECLIF
            STDEP(N,J)=0.
        65  CONTINUE
      C
      C     END OF MAIN PROGRAM LOOP
      C
         92 CONTINUE
            RETURN
            END
```

```
      SUBROUTINE NETSUB
C
C     COMPUTE EARNINGS AND TAXES
C
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25)
      LEVEL 2,
     X          AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,   CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,   DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,        INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,     PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,     SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,   STDEP,    SYNTRS,   YNTRST,
     7COST,     PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      COMMON/IN/AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,   CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,   DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,        INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,     PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,     SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,   STDEP,    SYNTRS,   YNTRST,
     7COST,     PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      REAL INTINV,INCTAX,NTEARN
C
C     MAIN PROGRAM LOOP POINT FOR EACH AIRCRAFT - WRITE DEPRECIATION AND
C     EARNINGS WHEN CALCULATED
C
      DO 94 J=1,NAC
      WRITE (6,53) DEPR(I,J)
   53 FORMAT (* DEPR= *,10E12.4)
      WRITE (6,61) STDEP(I,J)
   61 FORMAT (* STDEP= *,10E12.4)
      EBIAT(I,J)=AREV(I,J)-OPCOST(I,J)-DEPR(I,J)-STDEP(I,J)
      EBT(I,J)=EBIAT(I,J)-YNTRST(I,J)
      WRITE (6,20) EBIAT(I,J)
   20 FORMAT (* EBIAT= *,10E12.4)
      WRITE (6,30) EBT(I,J)
   30 FORMAT (* EBT = *,10E12.4)
      INCTAX(I,J)=(EBT(I,J))*(TXRATE)
      NTEARN(I,J)=EBT(I,J)-INCTAX(I,J)
C
C     END OF MAIN PROGRAM LOOP
C
   94 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SUM                                                     SUM    2
C                                                                        SUM    3
C     CALCULATE YEARLY AND CUMULATIVE SUMS FOR ALL REVENUE, PAYMENTS     SUM    4
C     AND EARNINGS                                                       SUM    5
C                                                                        SUM    6
      DIMENSION AREV(25,100),CF(25),COST(25,100),                        SUM    7
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),        SUM    8
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),       SUM    9
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),            SUM   10
     4STDEP(25,100),YNTRST(25,100),                                      SUM   11
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),    SUM   12
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),   SUM   13
     7DEPREC(25),PRICE(25,100),CSDCF(25),                                SUM   14
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),             SUM   15
     9CGTX(25,100),SCGTX(25)                                             SUM   16
      LEVEL 2,                                                           SUM   17
     X         AREV,     CF,       CSAREV,   CSCF,     CSDCF,   CSDEPR,  SUM   18
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,  CSPRIN,  SUM   19
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,     ECLIFE,  SUM   20
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,  OPCOST,  SUM   21
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,   SEBIAT,  SUM   22
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,   SSALVG,  SUM   23
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,                               SUM   24
     7COST,    PRICE,    RES,      RRATE,    TXRATE,                     SUM   25
     8BVALUE                                                             SUM   26
      COMMON/IN/AREV,    CF,       CSAREV,   CSCF,     CSDCF,   CSDEPR,  SUM   27
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,  CSPRIN,  SUM   28
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,     ECLIFE,  SUM   29
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,  OPCOST,  SUM   30
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,   SEBIAT,  SUM   31
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,   SSALVG,  SUM   32
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,                               SUM   33
     7COST,    PKICE,    RES,      RRATE,    TXRATE,                     SUM   34
     8BVALUE                                                             SUM   35
      REAL INTINV,INCTAX,NTEARN                                          SUM   36
C                                                                        SUM   37
C     PROGRAM STRUCTURE IS SMALL LOOPS TO CALCULATE THE REQUIRED SUMS    SUM   38
C                                                                        SUM   39
      DO 31 M=1,NAC                                                      SUM   40
      WRITE (6,33) (INTINV(I,M),I=1,IYEAR)                               SUM   41
   33 FORMAT (* INTINV= *,10E12.4)                                       SUM   42
   31 CONTINUE                                                           SUM   43
C                                                                        SUM   44
C     ANNUAL REVENUE                                                     SUM   45
C                                                                        SUM   46
      DO 10 N=1,IYEAR                                                    SUM   47
      SAREV(N)=0.0                                                       SUM   48
      DO 10 J=1,NAC                                                      SUM   49
      SAREV(N)=AREV(N,J)+SAREV(N)                                        SUM   50
   10 CONTINUE                                                           SUM   51
      CSAREV=0.0                                                         SUM   52
      DO 12 N=1,IYEAR                                                    SUM   53
      CSAREV=SAREV(N)+CSAREV                                             SUM   54
   12 CONTINUE                                                           SUM   55
C                                                                        SUM   56
C     SALVAGE VALUE                                                      SUM   57
C                                                                        SUM   58
```

```
      DO 20 N=1,IYEAR
      SSALVG(N)=0.0
      DO 20 J=1,NAC
      SSALVG(N)=SALVAG(N,J)+SSALVG(N)
   20 CONTINUE
C
C     INITIAL INVESTMENT
C
      DO 30 N=1,IYEAR
      SINTIN(N)=0.0
      DO 30 J=1,NAC
      SINTIN(N)=INTINV(N,J)+SINTIN(N)
   30 CONTINUE
      WRITE (6,21) (SINTIN(N),N=1,IYEAR)
   21 FORMAT(* SINTIN= *,10E12.4)
      CSINTI=0.0
      DO 32 N=1,IYEAR
      CSINTI=SINTIN(N)+CSINTI
   32 CONTINUE
C
C     PRINCIPAL PAYMENTS
C
      DO 40 N=1,IYEAR
      SPRIN(N)=0.0
      DO 40 J=1,NAC
      SPRIN(N)=PRIN(N,J)+SPRIN(N)
   40 CONTINUE
      CSPRIN=0.0
      DO 42 N=1,IYEAR
      CSPRIN=SPRIN(N)+CSPRIN
   42 CONTINUE
C
C     OPERATING COSTS
C
      DO 50 N=1,IYEAR
      SOPCST(N)=0.0
      DO 50 J=1,NAC
      SOPCST(N)=OPCOST(N,J)+SOPCST(N)
   50 CONTINUE
      CSOPCT=0.0
      DO 52 N=1,IYEAR
      CSOPCT=SOPCST(N)+CSOPCT
   52 CONTINUE
C
C     DEPRECIATION
C
      DO 60 N=1,IYEAR
      SDEPR(N)=0.0
      DO 60 J=1,NAC
      WRITE (6,53) DEPR(N,J)
   53 FORMAT (* DEPR= *,10E12.4)
      SDEPR(N)=DEPR(N,J)+SDEPR(N)
   60 CONTINUE
      DO 70 N=1,IYEAR
      SSTDEP(N)=0.0
      DO 70 J=1,NAC
      WRITE (6,61) STDEP(N,J)
```

```
   61   FORMAT (* STDEP= *,10E12.4)
        SSTDEP(N)=STDEP(N,J)+SSTDEP(N)
     70 CONTINUE
        DO 75 N=1,IYEAR
        DEPREC(N)=SDEPR(N)+SSTDEP(N)
        WRITE (6,71) DEPREC(N)
   71   FORMAT (* DEPREC= *,10E12.4)
     75 CONTINUE
        CSDEPR=0.0
        DO 77 N=1,IYEAR
        CSDEPR=DEPREC(N)+CSDEPR
     77 CONTINUE
C
C       EARNINGS BEFORE INTEREST AND TAXES
C
        DO 80 N=1,IYEAR
        SEBIAT(N)=0.0
        DO 80 J=1,NAC
        SEBIAT(N)=EBIAT(N,J)+SEBIAT(N)
     80 CONTINUE
        CSEBIT=0.0
        DO 82 N=1,IYEAR
        CSEBIT=SEBIAT(N)+CSEBIT
     82 CONTINUE
C
C       INTEREST PAYMENTS
C
        DO 90 N=1,IYEAR
        SYNTRS(N)=0.0
        DO 90 J=1,NAC
        SYNTRS(N)=YNTRST(N,J)+SYNTRS(N)
     90 CONTINUE
        CSYNTR=0.0
        DO 92 N=1,IYEAR
        CSYNTR=SYNTRS(N)+CSYNTR
     92 CONTINUE
C
C       EARNINGS BEFORE TAXES
C
        DO 100 N=1,IYEAR
        SEBT(N)=0.0
        DO 100 J=1,NAC
        SEBT(N)=EBT(N,J)+SEBT(N)
    100 CONTINUE
        CSEBT=0.0
        DO 102 N=1,IYEAR
        CSEBT=SEBT(N)+CSEBT
    102 CONTINUE
C
C       INCOME TAX
C
        DO 110 N=1,IYEAR
        SINCTX(N)=0.0
        DO 110 J=1,NAC
        SINCTX(N)=INCTAX(N,J)+SINCTX(N)
    110 CONTINUE
        CSINTX=0.0
```

```
      DO 112 N=1,IYEAR                                         SUM     173
      CSINTX=SINCTX(N)+CSINTX                                  SUM     174
  112 CONTINUE                                                 SUM     175
C                                                              SUM     176
C     NET EARNINGS                                             SUM     177
C                                                              SUM     178
      DO 120 N=1,IYEAR                                         SUM     179
      SNTERN(N)=0.0                                            SUM     180
      DO 120 J=1,NAC                                           SUM     181
      SNTERN(N)=NTEARN(N,J)+SNTERN(N)                          SUM     182
  120 CONTINUE                                                 SUM     183
      CSNTRN=0.0                                               SUM     184
      DO 122 N=1,IYEAR                                         SUM     185
      CSNTRN=SNTERN(N)+CSNTRN                                  SUM     186
  122 CONTINUE                                                 SUM     187
      RETURN                                                   SUM     188
      END                                                      SUM     189
```

```
      SUBROUTINE CFSUB                                                  CFSUB     2
C                                                                       CFSUB     3
C     COMPUTE THE CASHFLOW FOR EACH YEAR UNDER STUDY                    CFSUB     4
C                                                                       CFSUB     5
      DIMENSION AREV(25,100),CF(25),COST(25,100),                       CFSUB     6
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),       CFSUB     7
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),DPCOST(25,100),      CFSUB     8
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),           CFSUB     9
     4STDEP(25,100),YNTRST(25,100),                                     CFSUB    10
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SDPCST(25),SDEPR(25),   CFSUB    11
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),  CFSUB    12
     7DEPREC(25),PRICE(25,100),CSDCF(25),                               CFSUB    13
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),            CFSUB    14
     9CGTX(25,100),SCGTX(25)                                            CFSUB    15
      LEVEL 2,                                                          CFSUB    16
     X          AREV,     CF,       CSAREV,   CSCF,     CSDCF,   CSDEPR,CFSUB    17
     1CSEBIT,   CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSDPCT,  CSPRIN,CFSUB    18
     2CSYNTR,   DCF,      DEPR,     DEPREC,   EBIAT,    EBT,     ECLIFE,CFSUB    19
     3I,        INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,  DPCOST,CFSUB    20
     4PRIN,     PV,       R,        SALVAG,   SAREV,    SDEPR,   SEBIAT,CFSUB    21
     5SEBT,     SINCTX,   SINTIN,   SNTERN,   SDPCST,   SPRIN,   SSALVG,CFSUB    22
     6SSTDEP,   STDEP,    SYNTRS,   YNTRST,                             CFSUB    23
     7COST,     PRICE,    RES,      RRATE,    TXRATE,                   CFSUB    24
     8BVALUE                                                            CFSUB    25
      COMMON/IN/AREV,     CF,       CSAREV,   CSCF,     CSDCF,   CSDEPR,CFSUB    26
     1CSEBIT,   CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSDPCT,  CSPRIN,CFSUB    27
     2CSYNTR,   DCF,      DEPR,     DEPREC,   EBIAT,    EBT,     ECLIFE,CFSUB    28
     3I,        INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,  DPCOST,CFSUB    29
     4PRIN,     PV,       R,        SALVAG,   SAREV,    SDEPR,   SEBIAT,CFSUB    30
     5SEBT,     SINCTX,   SINTIN,   SNTERN,   SDPCST,   SPRIN,   SSALVG,CFSUB    31
     6SSTDEP,   STDEP,    SYNTRS,   YNTRST,                             CFSUB    32
     7COST,     PRICE,    RES,      RRATE,    TXRATE,                   CFSUB    33
     8BVALUE                                                            CFSUB    34
      REAL INTINV,INCTAX,NTEARN                                         CFSUB    35
C                                                                       CFSUB    36
C     CALCULATE CASHFLOW FOR EACH YEAR                                  CFSUB    37
C                                                                       CFSUB    38
      DO 50 N=1,IYEAR                                                   CFSUB    39
      CF(N)=SAREV(N)+SSALVG(N)-SINTIN(N)-SPRIN(N)-SDPCST(N)             CFSUB    40
     1-SYNTRS(N)-SINCTX(N)                                              CFSUB    41
   50 CONTINUE                                                          CFSUB    42
C                                                                       CFSUB    43
C     WRITE CALCULATED CASHFLOW                                         CFSUB    44
C                                                                       CFSUB    45
      WRITE (6,60) (CF(N),N=1,IYEAR)                                    CFSUB    46
   60 FORMAT(* CASH FLOW= *,10E12.4)                                    CFSUB    47
      CSCF=0.0                                                          CFSUB    48
C                                                                       CFSUB    49
C     COMPUTE CUMULATIVE TOTAL CASHFLOW                                 CFSUB    50
C                                                                       CFSUB    51
      DO 100 N=1,IYEAR                                                  CFSUB    52
      CSCF=CF(N)+CSCF                                                   CFSUB    53
  100 CONTINUE                                                          CFSUB    54
      RETURN                                                            CFSUB    55
      END                                                               CFSUB    56
```

```
      SUBROUTINE DCFSUB                                                 DCFSUB   2
C                                                                       DCFSUB   3
C     CALCULATE INTERNAL RATE OF RETURN ON INVESTMENT FOR INDICATED     DCFSUB   4
C     CASHFLOW                                                          DCFSUB   5
C                                                                       DCFSUB   6
      DIMENSION AREV(25,100),CF(25),COST(25,100),                       DCFSUB   7
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),       DCFSUB   8
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),      DCFSUB   9
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),           DCFSUB  10
     4STDEP(25,100),YNTRST(25,100),                                     DCFSUB  11
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),   DCFSUB  12
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),  DCFSUB  13
     7DEPREC(25),PRICE(25,100),CSDCF(25),                               DCFSUB  14
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),            DCFSUB  15
     9CGTX(25,100),SCGTX(25)                                            DCFSUB  16
      LEVEL 2,                                                          DCFSUB  17
     X         AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,  DCFSUB  18
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,  DCFSUB  19
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,  DCFSUB  20
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,  DCFSUB  21
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,  DCFSUB  22
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,  DCFSUB  23
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,                                DCFSUB  24
     7COST,    PRICE,    RES,      RRATE,    TXRATE,                      DCFSUB  25
     8BVALUE                                                              DCFSUB  26
      COMMON/IN/AREV,    CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,  DCFSUB  27
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,  DCFSUB  28
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,  DCFSUB  29
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,  DCFSUB  30
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,  DCFSUB  31
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,  DCFSUB  32
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,                                DCFSUB  33
     7COST,    PRICE,    RES,      RRATE,    TXRATE,                      DCFSUB  34
     8BVALUE                                                              DCFSUB  35
      REAL INTINV, INCTAX, NTEARN                                       DCFSUB  36
C                                                                       DCFSUB  37
C     INITIALIZE LOOP AND TEST PARAMETERS                               DCFSUB  38
C                                                                       DCFSUB  39
      REAL K,KK,KKK                                                     DCFSUB  40
      KK=0.                                                             DCFSUB  41
      KKK=0.                                                            DCFSUB  42
      RR=0.                                                             DCFSUB  43
      RRR=0.                                                            DCFSUB  44
      ICNT=0                                                            DCFSUB  45
C                                                                       DCFSUB  46
C     SET STARTING VALUE FOR R                                          DCFSUB  47
C                                                                       DCFSUB  48
      IF (CSCF.LT.0.0) GO TO 50                                         DCFSUB  49
      R=0.01                                                            DCFSUB  50
      GO TO 40                                                          DCFSUB  51
   50 R=-0.01                                                           DCFSUB  52
C                                                                       DCFSUB  53
C     MAIN ITERATION CYCLE POINT - CALCULATE DISCOUNTED CASHFLOW SUM    DCFSUB  54
C                                                                       DCFSUB  55
   40 DO 48 N=1,IYEAR                                                   DCFSUB  56
   48 PV(N)=(1.+R)**(-N)                                                DCFSUB  57
      SUM=CF(1)                                                         DCFSUB  58
```

```
      DCF(1)=CF(1)                                                      DCFSUB   59
      DO 500 N=2,IYEAR                                                  DCFSUB   60
      DCF(N)=CF(N)*PV(N-1)                                              DCFSUB   61
      SUM=SUM+DCF(N)                                                    DCFSUB   62
  500 CONTINUE                                                          DCFSUB   63
   70 K=ABS(SUM)-9000.                                                  DCFSUB   64
C                                                                       DCFSUB   65
C     IF CURRENT AND SECOND TO LAST SUMS ARE THE SAME, VALUES NEEDED    DCFSUB   66
C     HAVE BEEN FOUND                                                   DCFSUB   67
C                                                                       DCFSUB   68
      IF(KKK.EQ.K) GO TO 10                                             DCFSUB   69
      KKK=KK                                                            DCFSUB   70
      RRR=RR                                                            DCFSUB   71
      KK=K                                                              DCFSUB   72
      RR=R                                                              DCFSUB   73
      ICNT=ICNT+1                                                       DCFSUB   74
C                                                                       DCFSUB   75
C     WRITE VALUES OF R AND K EVERY TENTH ITERATION CYCLE               DCFSUB   76
C                                                                       DCFSUB   77
      IF(MOD(ICNT,10).NE.0) GO TO 75                                    DCFSUB   78
      WRITE(6,101) R,K                                                  DCFSUB   79
   75 CONTINUE                                                          DCFSUB   80
C                                                                       DCFSUB   81
C     VALUES NEEDED HAVE BEEN FOUND IF K IS NEAR ZERO OR NEGATIVE       DCFSUB   82
C                                                                       DCFSUB   83
      IF(K.LE.1.E-32) GO TO 20                                          DCFSUB   84
C                                                                       DCFSUB   85
C     INCREMENT R FOR NEXT ITERATION CYCLE                              DCFSUB   86
C                                                                       DCFSUB   87
      IF (SUM) 60,20,30                                                 DCFSUB   88
C     ASSUME DELTA R                                                    DCFSUB   89
 60   R=R-0.001                                                         DCFSUB   90
      GO TO 80                                                          DCFSUB   91
 30   R=R+0.001                                                         DCFSUB   92
C                                                                       DCFSUB   93
C     TRANSFER TO PERFORM NEXT ITERATION CYCLE                          DCFSUB   94
C                                                                       DCFSUB   95
 80   GO TO 40                                                          DCFSUB   96
C                                                                       DCFSUB   97
C     SELECT PROPER VALUE FOR R WHEN DONE                               DCFSUB   98
C                                                                       DCFSUB   99
   10 CONTINUE                                                          DCFSUB  100
      IF(KKK-KK) 120,130,130                                            DCFSUB  101
  120 R=RRR                                                             DCFSUB  102
      GO TO 20                                                          DCFSUB  103
  130 R=RR                                                              DCFSUB  104
C                                                                       DCFSUB  105
C     CALCULATE DISCOUNTED CASHFLOW SUM AND WRITE FINAL VALUES FOR      DCFSUB  106
C     R AND K                                                           DCFSUB  107
C                                                                       DCFSUB  108
 20   CSDCF(1)=CF(1)                                                    DCFSUB  109
      DO 100 N=2,IYEAR                                                  DCFSUB  110
      CSDCF(N)=DCF(N)+CSDCF(N-1)                                        DCFSUB  111
  100 CONTINUE                                                          DCFSUB  112
      WRITE(6,101) R,K                                                  DCFSUB  113
  101 FORMAT(2F20.7)                                                    DCFSUB  114
      RETURN                                                            DCFSUB  115
```

```
115               END
                                                   DCFSUB     116
```

```
      SUBROUTINE OUTPUT
C
C     PRINT FINAL OUTPUT TABLES SUMMARIZING AIR CARRIER MODULE
C     OPERATIONS
C
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25)
      LEVEL 2,
     X         AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,
     7COST,    PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      COMMON/IN/AREV,    CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,
     7COST,    PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      REAL INTINV, INCTAX, NTEARN
C
C     WRITE FIRST OUTPUT PAGE
C
      WRITE (6,100)
  100 FORMAT(1H1,*YEAR*,9X,*ANNUAL*,16X,*INVESTMENT*,15X,*OPERATING*,
     15X,*DEPRECIATION*,2X,*EARNING BEFORE*,6X,*INTEREST*)
      WRITE (6,101)
  101 FORMAT(1H ,13X,*REVENUE*,10X,*INITIAL*,4X,*PRINCIPAL PAY*,9X,
     1*COST*,21X,*INTEREST AND TAX*)
      WRITE (6,102)
  102 FORMAT(1H ,15X,*($)*,14X,*($)*,11X,*($)*,14X,*($)*,12X,*($)*,14X,
     1*($)*,13X,*($)*)
      DO 20 N=1,IYEAR
      WRITE (6,300) N,SAREV(N),SINTIN(N),SPRIN(N),SOPCST(N),
     1DEPREC(N),SEBIAT(N),SYNTRS(N)
  300 FORMAT(1H0,I4,6X,F13.2,4X,F12.2,3X,F12.2,4X,F12.2,4X,F12.2,4X,
     1F12.2,4X,F12.2)
   20 CONTINUE
      WRITE (6,104)
  104 FORMAT(1H0,10X,13(1H-),4X,12(1H-),3X,12(1H-),4X,12(1H-),4X,
     112(1H-),4X,12(1H-),4X,12(1H-))
      WRITE (6,105) CSAREV,CSINTI,CSPRIN,CSOPCT,CSDEPR,CSEBIT,CSYNTR
```

```
  105 FORMAT(1H0,*TOTALS*,4X,F13.2,3X,F13.2,2X,F13.2,3X,F13.2,3X,F13.2,
     13X,F13.2,3X,F13.2)
C
C     WRITF SECOND OUTPUT PAGE
C
      WRITE (6,200)
  200 FORMAT(1H1, *YEAR*,8X,*EARNINGS*,10X,*INCOME*,11X,*NET*,11X,
     1*NET CASH*,5X,*DISCOUNT*,6X,*DISCOUNTED*,16X,*NPV*)
      WRITE (6,201)
  201 FORMAT(1H ,11X,*BEFORE TAX*,11X,*TAX*,10X,*EARNINGS*,10X,*FLOW*,
     18X,*FACTOR*,8X,*CASH FLOW*)
      WRITE (6,202) R
  202 FORMAT(1H ,14X,*($)*,15X,*($)*,12X,*($)*,13X,*($)*,7X,
     1*ROI=*,F6.3,9X,*($)*,20X,*($)*)
      N=1
      WRITE(6,399) N,SEBT(N),SINCTX(N),SNTERN(N),CF(N),DCF(N),CSDCF(N)
  399 FORMAT(1H0,I4,F18.2,3F16.2,3X,9H    1.0000,F17.2,F22.2)
      DO 30 N=2,IYEAR
      NN=N-1
      WRITE(6,400) N,SEBT(N),SINCTX(N),SNTERN(N),CF(N),PV(NN),DCF(N),
     1CSDCF(N)
  400 FORMAT(1H0,I4,6X,E12.2,3F16.2,F12.4,F17.2,F22.2)
   30 CONTINUE
      WRITE (6,204)
  204 FORMAT(1H0,10X,12(1H-),4X,12(1H-),4X,12(1H-),4X,12(1H-),17X,
     112(1H-))
      WRITE (6,205) CSEBT,CSINTX,CSNTRN,CSCF,CSDCF(IYEAR)
 `205 FORMAT(1H0,*TOTALS*,3X,E13.2,F16.2,3X,E13.2,F16.2,12X,F17.2)
      RETURN
      END
```

ORIGINAL PAGE IS OF POOR QUALITY

```
      SUBROUTINE TAX
C
C     CALCULATE EFFECTS OF LOSS CARRIED BACKWARDS AND FORWARDS.
C     ALSO CAPITAL GAINS TREATMENT
C
      DIMENSION AREV(25,100),CF(25),COST(25,100),
     1DCF(25),DEPR(25,100),EBIAT(25,100),EBT(25,100),ECLIFE(100),
     2INCTAX(25,100),INTINV(25,100),NTEARN(25,100),OPCOST(25,100),
     3PRIN(25,100),PV(25),RES(100),RRATE(100),SALVAG(25,100),
     4STDEP(25,100),YNTRST(25,100),
     5SAREV(25),SSALVG(25),SINTIN(25),SPRIN(25),SOPCST(25),SDEPR(25),
     6SSTDEP(25),SEBIAT(25),SYNTRS(25),SEBT(25),SINCTX(25),SNTERN(25),
     7DEPREC(25),PRICE(25,100),CSDCF(25),
     8SEXP(25),SINCOM(25),CG(25,100),BVALUE(25,100),SCG(25),
     9CGTX(25,100),SCGTX(25)
      LEVEL 2,
     X         AREV,     CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,
     7COST,    PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      LEVEL 2,CG,CGTX
      COMMON/IN/AREV,    CF,       CSAREV,   CSCF,     CSDCF,    CSDEPR,
     1CSEBIT,  CSEBT,    CSINTI,   CSINTX,   CSNTRN,   CSOPCT,   CSPRIN,
     2CSYNTR,  DCF,      DEPR,     DEPREC,   EBIAT,    EBT,      ECLIFE,
     3I,       INCTAX,   INTINV,   IYEAR,    NAC,      NTEARN,   OPCOST,
     4PRIN,    PV,       R,        SALVAG,   SAREV,    SDEPR,    SEBIAT,
     5SEBT,    SINCTX,   SINTIN,   SNTERN,   SOPCST,   SPRIN,    SSALVG,
     6SSTDEP,  STDEP,    SYNTRS,   YNTRST,
     7COST,    PRICE,    RES,      RRATE,    TXRATE,
     8BVALUE
      COMMON/CG/CG
      COMMON/CGTX/CGTX
      REAL INTINV,INCTAX,NTEARN
C     EVALUATING LOSSES AND CARRYING THEM FORWARD AND BACKWARDS,
C     DETERMINING CAPITAL GAINS TAX AND READJUSTING NET EARNINGS,
C     AND INCOME TAX APPROPRIATELY
C
C     PARAMETER INITIALIZATION
C
      DO 20 N=1,IYEAR
      SEXP(N)= SOPCST(N)+DEPREC(N)+SYNTRS(N)
C     SINCOM SAME AS SEBT
      SINCOM(N)=SAREV(N)-SEXP(N)
   20 CONTINUE
C
C     START OF LOOP TO CALCULATE LOSS CARRIED BACKWARDS AND FORWARD.
C     ROUTINE STOPS IF A YEAR WITH NET POSITIVE INCOME IS FOUND FOR
C     EACH AIRCRAFT
C
      DO 400 N=1,IYEAR
      IF(SINCOM(N).GT.0.0) GO TO 300
      ALOSS=SINCOM(N)
```

```
C     WE CAN CARRY THE LOSS BACK 3 YEARS - FORWARD 5 YEARS AND MODIFY
C     SEBT
      IF(N.LT.2) GO TO 200
      IF(N.EQ.2) GO TO 25
      IF(N.EQ.3) GO TO 35
      IF(N.GE.4) GO TO 45
C
C     SPECIAL CARRY BACK CASE - YEAR=2
C
 25   K=N-1
      IF (SINCOM(K).LE.0.0) GO TO 14
      SINCOM(K)=SINCOM(K)+ALOSS
      ALOSS=SINCOM(K)
 14   IF(ALOSS.GE.0.0)GO TO 300
      IF(ALOSS.LT.0.0) GO TO 200
C
C     SPECIAL CARRY BACK CASE - YEAR=3
C
 35   M=N-2
      L=N-1
      DO 50 K=M,L
      IF (SINCOM(K).LE.0.0) GO TO 1000
      SINCOM(K)=SINCOM(K)+ALOSS
      ALOSS=SINCOM(K)
 1000 IF(ALOSS.GE.0.0)GO TO 300
 50   CONTINUE
      IF(ALOSS.LT.0.0) GO TO 200
C
C     GENERAL CARRY BACKWARD CASE
C
 45   M=N-3
      L=N-1
      DO 60 K=M,L
      IF (SINCOM(K).LE.0.0) GO TO 2000
      SINCOM(K)=SINCOM(K)+ALOSS
      ALOSS=SINCOM(K)
 2000 IF(ALOSS.GE.0.0)GO TO 300
 60   CONTINUE
      IF(ALOSS.LT.0.0) GO TO 200
C
C     LOSS CARRY FORWARD PORTION
C
 200  M=N+1
      IF(M-15)16,17,17
 16   L=N+5
      IF(L-15)18,19,19
 17   M=IYEAR
 19   L=IYEAR
 18   DO 70 K=M,L
      IF(SINCOM(K).LE.0.0) GO TO 70
      SINCOM(K)=SINCOM(K)+ALOSS
      ALOSS=SINCOM(K)
      IF(SINCOM(K).LT.0.0) SINCOM(K)=0.0
 70   CONTINUE
 400  CONTINUE
C
C     LOSS TREATMENT COMPLETED - UPDATE EARNINGS AND TAXES
```

```
      C
        300 DO 80 N=1,IYEAR
            SEBT(N)=SINCOM(N)
            SINCTX(N)=0.0
        80  CONTINUE
            DO 90 N=1,IYEAR
            SNTERN(N)=SEBT(N)
            IF(SEBT(N).LT.0.0) GO TO 90
            SNTERN(N)=SEBT(N)-SEBT(N)*TXRATE
            SINCTX(N)=SINCTX(N)+SEBT(N)*TXRATE
        90  CONTINUE
            DO 99 L=2,IYEAR
            M=L-1
            DEPREC(L)=DEPREC(L)+DEPREC(M)
        99  CONTINUE
      C
      C     CALCULATE CAPITAL GAINS TREATMENT
      C
      C     LONG TERM CAPITAL GAINS TAX
            DO 11 J=1,NAC
            M=ECLIFE(J)-1
            DO 75 L=1,M
      C     ASSUME SALVAGE VALUE  ZERO
            SALVAG(L,J)=0.0
        75  CONTINUE
            N=ECLIFE(J)
            SALVAG(L,J) =PRICE(1,J)*RES(J)
            DO 11 N=1,IYEAR
            SSALVG(N)=0.0
            SSALVG(N)=SALVAG(N,J)+SSALVG(N)
        11  CONTINUE
      C     CAPITAL GAINS=CG
        77  DO 111 L=1,IYEAR
            DO 111 J=1,NAC
            CG(L,J)=0.0
            CG(IYEAR,J)=PRICE(1,J)*RES(J)
            CGTX(L,J)=0.0
            IF(CG(L,J).LE.0.0) GO TO 333
            IF(CG(L,J).GE.25000.0) GO TO 66
            IF(CG(L,J).LT.25000.0) GO TO 44
        66  CGTAX=0.30
            GO TO 3
        44  CGTAX=0.22
            GO TO 3
        333 CGTAX=0.0
        3   CGTX(L,J)=CGTAX*CG(L,J)
            CG(L,J)=CG(L,J)-CGTX(L,J)
        111 CONTINUE
      C
      C     UPDATE CUMULATIVE SUMS
      C
            DO 88 N=1,IYEAR
            SCG(N)=0.0
            SCGTX(N)=0.0
            DO 88 J=1,NAC
            WRITE(6,8) CG(N,J)
        8   FORMAT(* CG = *,  E12.4)
```

```
              SCG(N)=CG(N,J)+SCG(N)                                         TAX      173
              SCGTX(N)=CGTX(N,J)+SCGTX(N)                                   TAX      174
         88   CONTINUE                                                      TAX      175
         55   DO 95 N=1,IYEAR                                               TAX      176
              SNTERN(N)=SNTERN(N)+SCG(N)                                    TAX      177
              SINCTX(N)=SINCTX(N)+SCGTX(N)                                  TAX      178
         95   CONTINUE                                                      TAX      179
              CSEBT=0.0                                                     TAX      180
              DO 102 N=1,IYEAR                                              TAX      181
              CSEBT=SEBT(N)+CSEBT                                           TAX      182
          102 CONTINUE                                                      TAX      183
              CSNTRN=0.0                                                    TAX      184
              DO 122 N=1,IYEAR                                              TAX      185
              CSNTRN=SNTERN(N)+CSNTRN                                       TAX      186
          122 CONTINUE                                                      TAX      187
              CSINTX=0.0                                                    TAX      188
              DO 112 N=1,IYEAR                                              TAX      189
              CSINTX=SINCTX(N)+CSINTX                                       TAX      190
          112 CONTINUE                                                      TAX      191
              RETURN                                                        TAX      192
              END                                                           TAX      193
```

Appendix F

COSMIC SOFTWARE SUBMITTAL INFORMATION

Appendix F

COSMIC SOFTWARE SUBMITTAL INFORMATION

Abstract

The Analysis of the Benefits and Costs of Aeronautical Research and Technology (ABC-ART) models have been developed by NASA for use in analyzing the economic feasibility of applying advanced aeronautical technology to future civil aircraft. The methodology is composed of three major modules: Fleet Accounting Module, Airframe Manufacturer Module, and Air Carrier Module.

The Fleet Accounting Module is used to estimate the number of new aircraft required as a function of time to meet demand. This estimation is based primarily upon the expected retirement age of existing aircraft and the expected change in revenue passenger miles demanded. Fuel consumption estimates are also generated by this module. The Airframe Manufacturer Module is used to analyze the feasibility of manufacturing the new aircraft demanded. The module includes logic for production scheduling and estimating manufacturing costs. For a series of aircraft selling prices, a cash flow analysis is performed and a rate of return on investment is calculated. The Air Carrier Module provides a tool for analyzing the financial feasibility of an airline purchasing and operating the new aircraft. This module includes a methodology for computing the air carrier direct and indirect operating costs, performing a cash flow analysis, and estimating the internal rate of return on investment for a set of aircraft purchase prices.

The ABC-ART models are exercised in two distinct job steps. The Fleet Accounting Module and Airframe Manufacturer Module are run in one job step. The Air Carrier Module is run in a second job step. The modules are

designed for batch processing. Hardware requirements include a card reader, a printer, and disk storage. In addition, plotter output is generated by the Fleet Accounting Module. The software is currently programmed for a ZETA 230 plotter. The models have been run of a CDC 7600 with the SCOPE 2.1.3 operating system. CPU time is very modest for either job step. However, core requirements are substantial. The first job step requires 132K octal words, the second requires 154K octal words small core memory plus 144K octal words of large core memory.

Method of Solution

The methodology embedded in the ABC-ART models is described in detail in Volume I of this report (NASA CR-152278). The methodology for the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules are described in Sections II, III, and IV, respectively.

Computer Configuration Required

The ABC-ART models have been run on the NASA AMES CDC 7600, with the SCOPE 2.1.3 operating system. The only required input device is a card reader. Required output devices include a printer, a plotter, and disk storage. The job step which exercises the Fleet Accounting and Airframe Manufacturer Modules requires a printer, a plotter (software is provided for the ZETA 230 plotter), and four output disk files, two for storage of data generated for the plotter and two for temporary storage of input data. The job step that exercises the Air Carrier Module requires only a printer and a card reader.

Memory Required

On the CDC 7600 there are two types of memory, small core memory (SCM) and large core memory (LCM)*. The Fleet Accounting and Airframe Manufacturer Modules require 132K octal words of SCM and no LCM. The Air Carrier Module requires 154K octal words of SCM and 144K words of LCM to run. Variables were placed in LCM using the LEVEL 2 conversion for the CDC 7600.

Source Language

The ABC-ART models are programmed in CDC FORTRAN extended 4 language. The reference manual for this language is CDC Publication Number 84000009. The ZETA 230 plotter software is written in the same language, except for a single COMPASS routine (less than 1% of the code). COMPASS can be compiled using the CDC FORTRAN compiler.

User Instructions

Instructions for use of ABC-ART models are provided in Volume I, Section V of this report where a sample run of the models is described.

Implementation Instructions

The software package is being submitted in the five data sets. Each data set consists of a single tape file except for the fifth data set, which is composed of four tape files. These files are described below:

---

*On the NASA Ames computer system, 160K octal words of SCM and 1,200K octal works of LCM are available.

Data Sets	Tape File	Contents
1	1	FORTRAN source code for the Fleet Accounting and Airframe Manufacturer Modules (see Appendices C and D).
2	2	FORTRAN and COMPASS source code for the ZETA 230 plotter software.
3	3	FORTRAN source code for the Air Carrier Module (see Appendix E).
4	4	Data input for the sample run of the Air Carrier Module (see Volume I, Table 41).
5	5,6,7,8	Data input for sample run of the Fleet Accounting and Airframe Manufacturer Modules (see Volume I, Table 40).

The tape containing these files is an unlabeled, 9-track tape in the EBCDIC character set with a density of 1600 BPI. The logical records are in card image format, 80 characters in length with no blocking. The tape was written on a CDC 7600 computer in SCOPE stranger format (i.e., F=S). No job control language is included in any of the files.

Program Timing

The CPU time required to run the ABC-ART models is quite modest. It will vary with the problem analyzed, the main factor being the number of new aircraft types. The sample run of the ABC-ART models, described in Volume I, Section V, took 22 and 4 CPU seconds for the Fleet Accounting and Airframe Manufacturer modules and Air Carrier Module, respectively. This time includes 5 and 3 CPU seconds, respectively, for compilation.

Accuracy of Results

The ABC-ART system does not contain mathematical or statistical routines that are very sensitive to word size. Single precision calculations on the CDC 7600 use a 60-bit word which provides a high degree of accuracy in computed results.

Sample Input and Output

Volume I of this report provides sample input and resulting output. In Section V, the sample problem is described, including a listing of the card input. Excerpts from the resulting printed and plotted output for the Fleet Accounting, Airframe Manufacturer and Air Carrier Modules are provided in Sections II, III, and IV, respectively.

Flowcharts

Flowcharts of the logic of each of the routines in the ABC-ART models have been provided in Volume I of this report. Flowcharts for the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules are provided in Sections II, III, and IV, respectively.

Program Listing

Listings of the FORTRAN code for the ABC-ART models are provided in Volume II of this report. Program listings for the Fleet Accounting, Airframe Manufacturer, and Air Carrier Modules are provided in Appendices C, D, and E, respectively.